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ORIGINAL SERIES.

ON THE ELECTRICAL CONDITION OF THE HUMAN FRAME, IN REFERENCE TO EPIDEMIC AND OTHER DISEASES, SUBMITTED TO THE BOARD OF HEALTH ON THE 29TH NOV., 1848.

By FRANKLIN COXWORTHY, Esq., Author of "Electrical Condition," &c.

All epidemic diseases being *now* generally referred to some electrical condition in the atmosphere, it is matter of moment that it be determined, in reference to the present prevailing complaint, what really is the electrical condition of the human frame.

Mr. Atkinson, of Westminster, in his remarks on an electrical phenomenon observed by him in cholera, states, "It was, indeed, singular to notice the quantity of electric fluid which continually discharged itself on the approach of any conducting body to the surface of the skin of a patient labouring under the collapse stage, more particularly if the patient had been previously enveloped in blankets: streams of electricity, many averaging *one inch and a half in length*, could be readily educted by the knuckle of the hand, when directed to any part of the body; and these appeared in colour, effect, crackling noise, and luminous character, similar to that which we are all accustomed to observe when touching a charged Leyden jar. I may remark the coincidence, that simultaneously with the heat of the body passing off, *the electricity was evolved;* and I am, therefore, led to ask the question,—Are not heat, electric and galvanic fluids, one and the same thing? does not the fact of the *passing off of both imponderable substances*, at one and the same time, strengthen this conclusion?"

It is evident from the above extract that Mr. Atkinson, like all other scientific men of the day, considers that electricity is identified with heat, and that the human body, being always at an elevated temperature by chemical action, induced by respiration, is positively electric, and, therefore, when passing into the cold or collapse stage of cholera, evolves free electricity.

All my experiments and all my experience go to show that all bodies, whilst evolving heat, are absorbing, and not parting with, electricity, and, consequently, evolve electricity when "absorbing heat" or "parting with cold;" and, therefore, instead of heat and electricity "passing off at one and the same time," they invariably travel in different directions: if in this I am right, as the cholera patient was passing into the collapse or cold state, it is obvious that the fluid must have passed to, and not from, him, as assumed by Mr. Atkinson.

Crystallization, that was formerly referred to "cold," is now known to be purely an electrical phenomenon, the rapidity of the operation being governed by the amount of electricity supplied; and if a crystallizable salt, in a warm solution, be connected, by a fine copper wire, with a freezing mixture ten feet off, the formation of the crystals will be rapidly accelerated thereby.

Here, then, we have clear evidence, not only that electricity is absorbed by a warm body whilst "parting with its heat," but that its connection with an intensely cold one, by a medium that in no way admits of the passage of "cold," greatly facilitates such absorption.

The above and other facts afford unquestionable evidence that electricity, which is evolved during the disintegration of matter, is identified with cold and not with heat; and on reference to "Electrical Condition" it will be observed that the same evidence has brought me to the conclusion, that electricity is the bond of union in matter; and that, as bodies attract each other in proportion to their difference of electrical condition, the attraction of matter to the earth's centre (the extreme of *negative* electrical condition) must be in proportion to its density or *positive* electrical condition.

Weight, then, should be nothing more than a kind of indication of the electric force by which a positive electric body is drawn to the negative centre of the earth; and, as matter increases in electrical condition in proportion to its density, it follows, as a natural inference, that matter, by compression or contraction, should increase in electrical condition, and therefore in weight.

I have not the means at my disposal to admit of my expressing the result obtained in figures; but I have arrived at satisfactory evidence that wood, by compression in a small vice,—lead, when passing from the molten state to the cold solid form,—and the admixture of sulphuric acid and water while cooling, *actually increase in weight.*

If we regard the question in its chemical bearings, evidence of a no less satisfactory character is afforded of the relative electrical condition of the human body when in a state of health or fever, or under the influence of an epidemic disease, such as cholera or influenza. If a compound of hydrogen and carbon, such as olefiant gas, be mixed with oxygen, in the proportion that the oxygen shall be equal only to the conversion of the hydrogen into water, on the mixture being fired by the electric spark, the oxygen and the hydrogen will combine, and the carbon is deposited; but if dead leaves, which contain hydrogen and carbon, be exposed, in a wet state, to the action of oxygen, that gas combines with the carbon, and the whole of the hydrogen is evolved as a light carburet.

Matter, when taken into the system, is converted under the influence of putrefaction into carbonic acid and compounds of hydrogen, and the offensive nature of these increases if the temperature of the system be raised by fever; but, if from any cause the body be thrown into a different electrical condition, the discharges consist of matter possessing but little smell; and during this change of state, or whilst the body is passing into the collapse or cold form, free electricity is absorbed to supply the demand occasioned by the contraction of the muscles, &c., so evident in the cramp, one of the attendant symptoms of cholera; and the copious discharge of water from the head during influenza I consider to be no less characteristic of the electrical condition of the body during the prevalence of that complaint.

It has been suggested that the blue colour of the blood in cholera is referable to the formation of prussian blue.

Under a negative or healthy state of the body the oxygen of the air combines with the carbon of the blood, and forms carbonic acid, and the hydrogen and nitrogen are resolved into ammonia; but, if the electrical condition be changed to the positive state, the chemical affinities of the elements are transposed. In this positive state, as under the influence of the electric spark, the oxygen, instead of combining with the carbon, unites with the hydrogen to form vapour, and the carbon and nitrogen in a nascent state naturally enter into combination, the formation of prussian blue being the result.

In the foregoing statement I have confined myself to a mere detail of principles or facts, as best calculated to elicit truth; and I hope that the evidence it affords will be deemed sufficiently conclusive to induce an inquiry being instituted, in order to determine whether electricity be identified with "heat" or with "cold," or which of the latter is in the positive state, and which in the negative state; it being obvious that, if epidemics be referable to electrical condition, all treatment of those complaints pending this information must be mere speculation, and the attempted remedies just as likely to accelerate the complaint as to arrest its progress; and the proportion of recoveries to the deaths cannot, I think, be adduced in proof of any knowledge being possessed of the nature of cholera and influenza.

Were this question merely of a medical character it would doubtless be out of place in me to urge new views on the consideration *of a body especially constituted by the Crown for its investigation;* but henceforth medicine, being inseparably connected with those branches of science which have so long engaged my attention, I shall not, I am sure, be deemed presumptuous in expressing a hope that the Honourable Board of Health will break ground on an inquiry which in its results cannot fail in bestowing on society an unprecedented amount of happiness, and in raising the standard of that great endowment which it has pleased the Creator to bestow on man above the brute creation.

STATEMENT SHOWING THE LEADING POINTS IN SCIENCE ON WHICH NEW VIEWS HAVE BEEN SUBMITTED TO PUBLIC CONSIDERATION BY MR. FRANKLIN COXWORTHY, COMPILED ON THE 11TH OF DECEMBER, 1848, TO FACILITATE A CONSIDERATION BY THE HONOURABLE THE BOARD OF HEALTH OF HIS PAPER OF THE 28TH OF NOVEMBER, 1848, ON THE "ELECTRICAL CONDITION OF THE HUMAN FRAME IN REFERENCE TO EPIDEMIC AND OTHER DISEASES."

Old Doctrines.	*New Doctrines.*
1. That vapour is both formed and decomposed during putrefaction.	1. That vapour is both formed and decomposed under the influence of high electrical conditions, but not during rot or putrefaction, carbon having then a greater affinity for oxygen than has hydrogen.

A principle of vast importance in its application to agriculture and the preservation of the health of towns.

2. That snow and rain are nothing but congealed and condensed vapour, the ammonia of rain and snow water being acquired from the atmosphere, clouds being also nothing but vapour.	2. That snow is the original form of rain, is a quadruple compound, and during its decrystallization yields water, ammonia, and carbon, which carbon constitutes the black cloud, and by vegetating is transformed into the white cloud.

At least six hundred million tons of ammonia are generated from the nitrogen annually liberated from the atmosphere in this country by combustion and respiration.

3. That *heat*, light, and electricity are identical.	3. That heat and cold are mere electrical conditions; *cold*, light, and electricity being identical.

The refulgence of the electric light is unaccompanied by heat.

4. That the earth is the emporium of electricity.	4. That the atmosphere in which we move, as compared to the earth, is positively electric, the condition, however, alternating at times.

This is beautifully illustrated by the evaporation of water from two vessels, one insulated and the other not.

5.	5. That epidemic diseases are mainly referable to those changes of electrical condition in the earth and the atmosphere.

This is now admitted on medical authority.

6. That dampness of buildings is referable to moisture drawn up through the walls by capillary attraction.	6. That dampness in buildings is referable to condensation of moisture on the surface of the walls on change of electrical condition in the atmosphere and the earth.

All buildings for the preservation of health and stores should be electrically insulated from the earth by the introduction of a course of block glass above the ground.

7. That the cause of magnetic condition in	7. That the magnetic condition of the earth

the earth is to be found in the earth.	is referable to the high electrical condition of the upper regions in which it revolves.

The British Association abandoned their observatory at their meeting at Swansea in 1848.

8. That the atmosphere is a mechanical mixture, the elements being held together by diffusion.	8. That the atmosphere is a chemical compound *originally formed and now regenerated by vegetation.*

A question of vast importance in reference to the ventilation of buildings.

9. That the tadpole is transformed from a *fish-breathing* animal to a *land-breathing* animal.	9. That "breathing" appertains only to warm-blooded animals, and not to fishes, frogs, and lizards.

This has been satisfactorily proved by a medical gentleman of high scientific attainments, who kept a lizard alive two months in an atmosphere of carbonic acid.

10. That matter is held together by an attraction of cohesion.	10. That electricity is the bond of union in matter, is absorbed during its contraction and formation, and evolved during disintegration or decrystallization.

This may readily be illustrated by crystallization; and by shaking in a bottle lumps of loaf sugar, or by turning them from one vessel into another, sparks of electricity are evolved.

11.	11. That gravitation is referable to electrical condition; and matter, therefore, by compression or contraction *actually increases in weight* with increase of specific gravity.

On this principle are based many plans for the ventilation of sewers and buildings.

12. That oxygen, chlorine, &c., are electro-negatives; and hydrogen, nitrogen, &c., electro-positives.	12. That oxygen, chlorine, &c., are electro-positives; hydrogen, nitrogen, &c., electro-negatives.

See "Electrical Condition," page 12.

Sandwich, Feb. 20, 1849.

My dear Sir,—If I have retained your papers longer than perhaps I ought, it is because they have interested me, especially your "Statements" comparing your own views and the doctrines of the *schools*. Stick to your "Electrical Condition." I have well reconsidered all, and my conviction is unchanged as well as unchangeable. Surely you will, ere long, bring your guns to bear direct on the enemy.

With kindest regards and best wishes,

Yours faithfully,

F. Coxworthy, Esq. W. H. Weekes.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

Part II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LX.

(LECTURE XCIII.)

VEGETO-ALKALIS—(*Continued*).

BARK.

We distinguish three principal species of officinal bark, viz.:—

Pale bark, attributed to Cinchona condaminea.
Yellow bark, attributed to Cinchona cordifolia.
Red bark, attributed to Cinchona oblongifolia.

The several varieties of Cinchona bark are justly celebrated for their febrifuge properties, which reside in the two organic alkalis, of which we have treated in the preceding lectures.

According to MM. Pelletier and Caventou, the pale, yellow, and red bark contain:—

Kinate of quinine
" cinchonine
Soluble cinchona red
Insoluble "
Yellow colouring matter
Grassgreen "
Kinate of lime
Starch
Gum
Lignose

In the pale bark the relative amount of the cinchonine is much more abundant than that of the quinine. In the yellow bark the relative proportion of the latter considerably exceeds that of the former. Adding the respective amount of the two alkalis together, the yellow bark is twice as rich in vegeto-alkali as the pale bark. In the red bark the relative proportions of the two alkalis are more evenly balanced, with a slight excess, perhaps, in favour of the quinine. The red bark is rarely as rich in vegeto-alkali as the yellow variety. To this I have to add, that MM. Henry and Plisson have found that a considerable proportion of the two alkalis is combined with the cinchona red.

KINATES OF QUININE AND CINCHONINE.

These two salts have been extracted from bark by MM. Henry and Plisson; they have an exceedingly bitter taste, resembling that of the bark. They are very readily soluble in water, but insoluble in alcohol of 36°; in more highly dilute alcohol they dissolve readily. Alkalis decompose them, and precipitate the quinine and cinchonine.

To obtain the kinates of quinine and cinchonine in the crystalline state, a solution of them is to be evaporated to dryness, and the residuary salt moistened with distilled water, whereupon it will gradually change to a mamellonated mass formed of brilliant crystals.

SOLUBLE CINCHONA RED.

The soluble cinchona red of MM. Pelletier and Caventou is a mixture of pure tannin and tannin which has suffered some alteration, but retains still its solubility in water. Berzelius has extracted from the soluble cinchona red a colourless tannin, which is exceedingly remarkable for the facility with which it suffers alteration, and is converted into the insoluble red, more particularly under the influence of alkalis. The compounds which this tannin forms with acids are more soluble than those formed by the tannin of gallnuts.

The soluble cinchona red has all the properties of tannin; it precipitates iron solutions green (the red extracted from the pale bark, however, precipitates these solutions brown).

The soluble cinchona red precipitates gelatine and tartar emetic.

With starch it forms a compound insoluble in the cold, soluble above 122° F.

The cinchona red abounds in the officinal species of bark. It has been found also (with some slight modification in its characteristic properties), by MM. Pelletier and Caventou, in the cinchona of Carthagena (Portlandia hexandra), and in the cinchona nova; by M. Kuhlmann in another species of bark; and by M. Henry in the bark of Condaminea tinctoria.

Many other species of bark, most of them as yet very imperfectly known, but belonging nearly all of them to the family of the Cinchoneæ, are used in medicine, or popularly as bitter, tonic, or astringent agents; such are, for instance, the bark of Remigia furruginea (Brazil), of Cinchona excelsa (India), of Exostema caraibæa, of Antirrhœa verticillata (island of Bourbon), of Mussinda stadtmanni, or Bela-Ayé (Mauritius).

The Cinchona laccifera of Peru, the bark of which yields a red juice, called cinchona lake, and the African kino, which exudes from the Uncaria gambir, are both rich in tannin, and present the greatest analogy with the preceding substances.

The bark of Exostema floribunda also resembles in most points the above-enumerated species, but it differs from them by its emetic properties.

INSOLUBLE CINCHONA RED.

The insoluble cinchona red is inodorous and insipid; it has a reddish-brown colour; it is almost insoluble in water and in ether, but dissolves very readily in alcohol.

The presence of acids promotes its solution in water to a very considerable degree. The aqueous solution obtained in the presence and by the influence of acids does not precipitate gelatine, but it precipitates tartar emetic.

Alkalis dissolve it readily. The insoluble cinchona red, precipitated from its alkaline solution by an acid, is found to have acquired the faculty of precipitating gelatine.

Cinchona red appears to be a product of the alteration of tannin. M. Braconnot has found in the barks of other trees a matter quite analogous to the cinchona red, and to which he has given the name corticin.

COMBINATION OF THE CINCHONA RED WITH QUININE AND CINCHONINE.

The combination of the insoluble cinchona red with the vegeto-alkalis in the bark has been demonstrated by MM. Henry and Plisson.

This combination altogether resembles in appearance the insoluble cinchona red; it has a slightly bitter taste, which becomes only slowly developed on the tongue. It is sparingly soluble in cold, somewhat more readily in boiling, water; the solution in boiling water becomes turbid on cooling.

Alcohol dissolves it readily. Acid liquors dissolve it with the aid of heat. The alkalis separate the quinine from it, and remain in combination with the cinchona red.

According to MM. Henry and Plisson's researches, it appears highly probable that there exists in bark, besides the preceding, another compound formed by the combination of the soluble cinchona red with the organic alkaline bases.

The fatty matter, the kinate of lime, and the colouring matter which exist in bark are of no importance in a medical point of view.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON THE DEPORTMENT OF IRON AND ZINC WITH SULPHURIC ACID AND ITS COMPOUNDS.

By ALBERT D'HEUREUSE.

The deportment of anhydrous sulphuric acid and of the sulphates with iron and other metals at a red heat had never been accurately investigated; it was known that they reacted on each other, and formed various products, which, however, had been but very imperfectly studied. The author has published his experiments on this subject in a very extensive memoir, from which we take the following:—

Anhydrous Sulphurous Acid with Iron or Zinc.—No reaction takes place at the ordinary temperature; at a red heat a thin iron wire, in contact with anhydrous sulphuric acid, becomes coated with a black stratum, consisting of a mixture of peroxide of iron with sulphuret of iron. A more perfect decomposition was obtained by placing in a spacious porcelain crucible a smaller one containing short pieces of thin iron wire; the whole was placed in a crucible with sulphate of bismuth, closed with a lid, and a mixture of clay and oxide of lead, which forms a very infusible glass on ignition. After exposure for half an hour to a red heat in a blast-furnace, the iron had become converted into a vesiculous fused mass of a metallic-green colour, partially yellowish or beautiful dark blue upon the surface, and with the fracture of a bronze colour. When reduced to a fine powder, it dissolved, but with difficulty and imperfectly, in cold muriatic acid with a yellow colour; on the application of heat, sulphuretted hydrogen was disengaged. To ascertain the

decomposition that had taken place, the iron and the product obtained by the action of the anhydrous sulphuric acid were weighed; and, lastly, the amount of sulphur determined in the latter. It was found that the decomposition should be expressed by the equation:—

$$4SO^3 + 13Fe = 3(FeO, Fe^2 O^3) + 4FeS.$$

A small portion of the sulphuric acid must, however, be decomposed at a strong red heat into oxygen and sulphurous acid, since the amount of sulphur found does not exactly correspond with the above decomposition.

When zinc is treated in a similar manner, a greenish-yellow powder, consisting of oxide and sulphuret of zinc, is obtained—

$$SO^3 + 4Zn = 3ZnO + ZnS.$$

Alkaline Sulphates with Zinc and Iron.—Sulphate of potash is entirely decomposed after exposure for a short time to a red heat with finely-divided iron. The blackish porous mass contains no sulphuret of potassium, but sulphuret of iron and caustic potash.

A direct analysis of the product could not be made. On this account the sulphuric acid remaining on ignition with an excess of sulphate of potash was determined; and it was found that 1 atom of sulphuric acid required 3 atoms of iron for its decomposition. The reaction takes place consequently according to the following formula:—

$$KO, SO^3 + 3Fe = KO + Fe^2 O^3 + FeS.$$

Although the decomposition of the sulphuric acid in the presence of an excess of iron is complete, this reaction cannot be used for the preparation of potash free from sulphur; because, on solution in water, a portion of the sulphuret of iron dissolves with a green colour, which disappears, it is true, with the access of air, but with the production of sulphuret of potassium and hyposulphite of potash.

An addition of copper prevents the solution of the sulphuret of iron; but even in this case the potash contains some hyposulphite. Impure carbonate of potash, however, can be entirely deprived of sulphur by fusion with iron.

When excess of zinc is heated to redness with sulphate of potash a compact mass of a lemon colour is obtained, which consists of sulphuret of potassium and oxide of zinc:—

$$KO, SO^3 + 4Zn = KS + 4ZnO.$$

On heating to redness a mixture of sulphate of potash with not too small a quantity of zinc, a remarkably beautiful deflagration takes place, which begins at a faint red heat at one point of the margin, and rises to a white heat when a portion of the zinc burns with a dazzling light.

Sulphate of Soda behaves towards iron almost exactly like the potash salt, only more sulphuret of iron is dissolved upon the addition of water. It likewise exhibits the same behaviour towards zinc.

Sulphate of Ammonia.—On boiling a solution of this salt with iron, ammonia escapes, and the solution contains a protosalt of iron. If the mixture is fused at a gentle heat, the disengagement of ammonia is still stronger, and the colour of the salt becomes darker and greenish on solution in water. On quickly applying a red heat to this mixture, sulphurous acid escapes along with the vapours of the salt, and the surface of the iron becomes coated with oxide and sometimes with sulphuret. This decomposition, however, does not appear to be direct, but to proceed from the protosulphate of iron produced in the fusion.

Zinc exhibits the same phenomena as iron.

Sulphate of Lime furnishes, when heated to redness with iron in a porcelain crucible, a greyish-black mass of metallic appearance, which contains sulphuret of calcium and an oxide of iron. By determining the amount of sulphuric acid which a known weight of iron decomposes, it was found that the following two decompositions must have occurred:—

$$CaO, SO^3 + 3Fe = CaS + FeO, Fe^2 O^3$$

and

$$3CaO, SO^3 + 8Fe = 3CaS + 4Fe^2 O^3.$$

Pure zinc furnishes, on being ignited with sulphate of lime, a yellowish imperfectly fused mass, which contains no sulphuret of calcium:—

$$CaO, SO^3 + 4Zn = CaO + 3ZnO + ZnS.$$

On heating a mixture of sulphate of baryta and iron to redness, a semifused metallic mass is obtained, which contains sulphuret of barium and oxide of iron. On comparing the quantities of the iron consumed and of the sulphate of baryta decomposed, it was found that the following two reactions must have taken place:—

$$BaO, SO^3 + 3Fe = BaS + FeO, Fe^2 O^3.$$

$$3BaO, SO^3 + 8Fe = BaS + 4Fe^2 O^3.$$

The decomposition of the sulphate of baryta is much more readily effected by iron than by coal; but the sulphuret of barium is only imperfectly extracted from the product by long boiling with water. Very good crystallized chloride of barium was obtained by heating to redness two parts of heavy spar, two parts of iron, and one part of chloride of calcium, reducing the cold mass to a powder, and exhausting with boiling water, and then adding a few drops of muriatic acid. This method of preparing chloride of barium always furnishes excellent results except when too high a temperature has been employed.

Zinc filings furnish, when heated to redness with sulphate of baryta, a compact greenish-yellow mass, which contains no sulphuret of barium:—

$$BaO, SO^3 + 4Zn = BaO + 3ZnO + ZnS.$$

The whole of the baryta, however, cannot be obtained by exhaustion with boiling water, it having entered into a combination with the oxide of zinc, which it is very difficult to decompose by water.

Pure sulphate of strontia requires a much higher temperature for its decomposition by iron than the salts of baryta and lime. The powdered mass more readily parts with sulphuret of strontium to water, but by no means with the whole. Chloride of strontium may be prepared from celestine in the same manner as directed under sulphate of baryta.

Zinc behaves towards this salt in the same manner as towards the salt of baryta.

Sulphate of Magnesia gives off much sulphurous acid on ignition with iron. A greyish mass is obtained, which exhibits at several spots white magnesia; the iron is converted into oxide, protoxide, and some sulphuret.

In these decompositions it is very remarkable that in those cases in which the iron appropriated both the constituents of the sulphuric acid the zinc combined only with the oxygen; and, where the latter metal had become converted into oxide and sulphuret, the iron remained united with the oxygen.—Poggendorff's *Annalen*, lxxv., p. 255, and *Chem. Gaz.*

ON THE ATOMIC WEIGHTS OF CERIUM AND BARIUM.

By M. MARIGNAC.

To determine the equivalent of cerium the author employed the sulphate of the protoxide of cerium, which is easily obtained crystallized and perfectly pure. To procure pure oxide of cerium the author recommends the following simple method:—Cerite, reduced to a fine powder, is mixed in a porcelain dish with concentrated sulphuric acid, so as to form a thick paste; on the application of heat a lively reaction occurs; the mass evolves considerable heat, becomes white, and a portion of the sulphuric acid is evaporated, so that in a few minutes nothing but a white dry powder is left. This is transferred into a clay crucible, which is kept for a long time at a temperature below red heat. After cooling the powder is diffused in cold water, care being taken to add it in small portions at the time, so that no heating may occur, which would cause the powder to cake together. Silica, coloured by some peroxide of iron, is left undissolved; it it is separated by filtration. The solutions of the sulphates are for the greater part precipitated by boiling; so that in general it is not worth the trouble to obtain the remainder from the solution. From this precipitate, which contains the sulphates of cerium, lanthanium, and didymium, the oxides are prepared according to the usual methods; and these are then separated according to the method described by Mosander. The oxide of cerium is most easy to obtain pure; this, as is well known, remains undissolved on treating the mixed oxides with nitric acid which has been diluted with one hundred times its weight of water. It is, however, requisite to avoid carefully any admixture of sulphuric acid, which is frequently found in the oxides precipitated from the sulphatic solutions by potash or ammonia. The best plan is to dissolve the oxides in nitric acid, and to precipitate the sulphuric acid with a little nitrate of baryta, after which the solution is evaporated to dryness and calcined. When the object is not so much to obtain the whole of the oxide of cerium as to procure it in as pure a state as possible, it is advisable, after the treatment with dilute nitric acid, to digest the residue with a more concentrated acid, which removes the last traces of didymium and lanthanium along with a small quantity of oxide of cerium. In every case, however, the oxide thus obtained must be redissolved, precipitated with carbonate of ammonia, heated to redness, and again treated with nitric acid. When the oxide of cerium is pure, it becomes almost insoluble in acids after calcination; so that it has to be treated with concentrated sulphuric acid, which readily converts it into sulphate. In this manner a yellow mass of the sulphate of the proto and per oxide of cerium is obtained, which dissolves readily in water and in the presence of a pretty large excess of sulphuric or nitric acid. The yellowish-red solution is set aside to clear; the liquid decanted, and diluted with a large amount of water, which precipitates the greater portion of the dissolved salt in the form of a yellow powder, almost perfectly insoluble in water. Any foreign salt it might contain can easily be removed by washing it with water. By boiling it with sulphuric and nitric acids until it is perfectly decolorized, and evaporating to dryness, it furnishes protosulphate of cerium.

The salt is perfectly colourless, and readily crystallizes on the slow cooling of the solution in rhombic octahedra, the surfaces of which are inclined to the terminal edges in angles of 114° 12′ and 111° 10′. There frequently occurred with these a more acute octahedron with angles of 99° 48′ and 95° 48′.

To obtain it free from any excess of acid it was dissolved in cold water, and the filtered liquid heated to boiling, when the greater portion of the salt was precipitated. The supernatant liquid was decanted, the precipitate dried, and a portion of it reserved for analysis, but another portion of it treated as above.

As the determination of the equivalent of cerium from this salt depends essentially on that of barium, the author repeated the determination of the latter equivalent according to the process of Pelouze. The chloride of barium for this purpose was purified in the following manner:—

A. Commercial chloride of barium was dissolved in boiling water, and crystallized by cooling.

B. The preceding, strongly calcined, dissolved in boiling water, treated with carbonic acid, filtered, and crystallized.

C. The preceding, washed with alcohol and recrystallized.

D. The preceding, after longer washing with alcohol.

The following results were obtained:—

	Silver.	Chloride of Barium.	Chloride of Barium for 100 parts of Silver.	Mean.
A.	3.4445	3.3190	96.356	96.354
	3.7480	3.6110	96.345	
	6.3446	6.1140	96.362	
B.	4.3360	4.1785	96.356	96.354
	4.8390	4.6625	96.352	
C.	6.9200	6.6680	96.358	96.360
	5.6230	5.4185	96.363	
D.	5.8435	5.6300	96.346	96.367
	8.5750	8.2650	96.384	
	4.8225	4.6470	96.361	
	6.8460	6.5980	96.377	

These experiments agree pretty accurately with

each other, so that the method undoubtedly merits confidence; however, the variations are greater than in those obtained by a similar method from chloride of potassium, which the author ascribes to the circumstance that the latter can be weighed in fragments, whilst chloride of barium must be dried as a powder in the crucible. It is at the same time evident that for such determinations of the atomic weight the chloride of barium can be perfectly dried at a faint red heat without decomposing it, whilst at a red heat it parts with chlorine and acquires an alkaline reaction. Taking the mean of the two last series of experiments, which were made with the purest salt (96.365 chloride of barium), the equivalent of barium is found to be 856.77 (O=100) or 68.54 (H=1), therefore almost exactly the mean of the numbers found by Berzelius and Pelouze.

The author then proceeded to determine the equivalent of cerium. He first ascertained that the sulphate of the protoxide of cerium may be dried completely, and without decomposition, at a temperature far below red heat. By precipitating with chloride of barium and weighing the precipitate he obtained:—

Sulphate of the Protoxide of Cerium.	Sulphate of Baryta.	Mean.
4.532	5.560 = 122.68 per cent.	
4.172	5.090 = 122.00 "	122.40
13.514	16.556 = 122.51 "	

The equivalent of cerium deducible from these is 590.2.

This method exhibits two sources of error, which, however, partly annul each other. On the one hand the sulphate of baryta always retains traces of oxide of cerium, which cannot be removed by long-continued washing; whilst, on the other hand, sulphate of baryta is soluble to some extent in the presence of salts of cerium. The author, therefore, resolved to determine the equivalent of cerium by precipitating the protosulphate of cerium with a measured solution containing a known quantity of chloride of barium. For this purpose it suffices to weigh off approximately the quantity of chloride of barium required to precipitate a weighed quantity of protosulphate of cerium, and to complete the precipitation by the addition of a standard solution. However, this method by no means answers so well as in the case of silver. Notwithstanding its weight, the sulphate of baryta separates very slowly, and the liquid must be let stand twenty-four hours after each experiment to obtain it perfectly clear. A portion is then transferred by means of a pipette into a very clear glass, some of the standard solution added, and then set aside for one or two hours to see whether any turbidness results or not; it is then added to the liquid. This circumstance merely influences the duration of the experiment; but the other, *i.e.*, the solubility of the sulphate of baryta in salts of cerium, interferes with its accuracy. Whilst in water acidified by sulphuric and muriatic acids an addition of from 4 to 6 milligrammes produces a perceptible troubling, it is requisite to add from 40 to 60 milligrammes of liquids containing salts of cerium for an addition of protosulphate of cerium to produce further turbidness.

Although, therefore, this process cannot furnish very accurate results, it is, nevertheless, preferable to the first, because it furnishes at least two limits within which the true equivalent must be included.

The mode of experiment was as follows:—Both salts were dried one after the other, weighed, and transferred into a bottle containing about 200 grms. of distilled water acidified with muriatic acid. As soon as the liquid had cleared, a little of it was poured into a glass; and, by means of a standard solution, 20 milligrammes of chloride of barium added, which produced a troubling. The liquid was returned into the bottle, allowed to deposit, and then a fresh quantity of 20 milligrammes of chloride of barium added; and this repeated as long as any milkiness resulted. The sum of the chloride of barium consumed furnished the lowest limit. The liquid was again returned to the flask, and 40 milligrammes of chloride of barium added, so that on the whole the lowest limit was exceeded by 60 milligrammes. As soon as the liquid had become clear, it was tested by the addition of 18.5 milligrammes protosulphate of cerium (which correspond to 20 milligrammes of chloride of barium); in every case a milkiness resulted, proving the presence of an excess of chloride of barium; the liquid was poured back, and subsequently again mixed with 18.5 milligrammes of the protosulphate; this did not always produce a turbidness, so that the highest limit might be reduced by 20 milligrammes. *A*, *B*, *C*, *D* are the results from the second, third, fourth, and fifth crystallizations of the protosulphate of cerium:—

	Protosulphate of Cerium.	Chloride of Barium. Min.	Chloride of Barium. Max.	Equiv. of Protosulphate of Cerium. Max.	Equiv. of Protosulphate of Cerium. Min.	Equiv. of Protosulphate of Cerium. Mean.
A.	11.014	11.990	12.050	1196.3	1188.2	1192.2
	13.194	14.365	14.425	1194.0	1189.0	1191.5
B.	13.961	15.225	15.285	1192.0	1187.4	1189.7
	12.627	13.761	13.821	1192.8	1187.7	1190.2
	11.915	12.970	13.030	1194.3	1188.7	1191.3
C.	14.888	16.223	16.283	1193.0	1188.6	1190.8
	14.113	15.383	15.423	1192.7	1189.5	1191.1
D.	13.111	14.270	14.330	1194.4	1189.4	1191.9
	13.970	15.223	15.283	1193.0	1188.3	1190.6

As the salts of the three last crystallizations furnish very nearly the same results, M. Marignac allows the last seven experiments a greater influence upon the mean result. The equivalent of the protosulphate of cerium is accordingly situated between 1193.1 and 1188.5, which last number must necessarily be too small, whilst the first is too great. It is uncertain to which of the two limits the true value is nearest; but no very great error will be committed by adopting the mean of these numbers, or 1190.8. This gives for the equivalent of cerium the number 590.8 (O=100) or 47.26 (H=1).

ON THE DOUBLE SULPHATE OF THE PROTO AND PER OXIDE OF CERIUM, BY M. MARIGNAC.

The author analyzed this salt after it had been dried at 212°. The sulphuric acid, cerium, and water were determined in the usual manner. The amount of peroxide of cerium contained in it was found by digesting the salt with a known weight of protoxide of iron in muriatic acid, and determining the excess of protoxide of iron with a normal solution of permanganate of potash, by which the amount of oxygen of the oxide could be calculated. The results obtained agree with the following composition:—

Protoxide of cerium ..	..	..	3	= 26.49
Peroxide of cerium ..	37.05	..	2	37.87
Sulphuric acid	26.17	26.09	4	25.57
Water	10.34	10.10	7	10.07

The author determined in the same manner the state of oxidation of the oxide left on calcining the nitrate of cerium. The weight of this residue varies after each calcination, so that it is impossible to employ it for an accurate quantitative determination. It is almost insoluble in muriatic acid, but dissolves in it when finely powdered in the presence of the protochloride of iron. Three products furnished:—

Protoxide of cerium (difference)	96.81	96.25	96.17
Excess of oxygen	3.19	3.75	3.83

There is, consequently, 22.7, 26.9, and 27.5 oxygen in excess for each equivalent of protoxide of cerium; which differs considerably from the composition of a sesquioxide, which should contain more than 50 per cent. oxygen.—*Arch. des Sciences Phys. et Nat.*

ON CHLORONICEIC ACID, AND ON THE NATURE AND COMPOSITION OF VARIOUS CHLORONICEATES.

By M. E. SAINT-EVRE.

For the preparation of this acid the first operation consists in passing a current of moist chlorine gas into a cold and strongly alkaline solution of benzoate of potash. After many trials, the proportions which succeeded best were found to be 60 grms. of benzoic acid, 200 grms. of hydrate of potash, and 300 to 350 grms. of water, according to the degree of hydratation of the potash of commerce, which is far from being constant.

The potash is to be dissolved at a gentle heat, and the benzoic acid afterwards added; and the chlorine is not to be passed till everything is dissolved. After some time the solution assumes successive shades of yellow, greenish-yellow, and bright green; it then again becomes yellow, and eventually deposits an abundant pulpy compound, which is greyish and crystalline. An abundant evolution of carbonic acid takes place during the operation, which is readily detected by passing it into a vessel containing barytes-water. An operation performed with the quantities above described continues about two days.

The precipitate is composed:—

1st. Of chlorate of potash, the crystallization of which is completely modified by the presence of organic matter, the salt being usually obtained in the form of four-sided prisms. They are long, hard, and brittle.

2d. Of a small quantity of unaltered benzoate of potash.

3d. Of a salt of potash containing the new acid.

And lastly, the supernatant liquor contains benzoate of potash and chloride of potassium.

About half its volume of water is to be added to the mass. The solution is to be saturated, at a moderate temperature, by means of a current of carbonic acid, the saturation being completed by the addition of a small quantity of dilute hydrochloric acid. The solution is then to be boiled. The magma which is precipitated gradually redissolves, and there soon appears an oleaginous substance which is fusible at about 270° F.; it is of an amber colour, and heavier than water. It sometimes precipitates to the bottom of the capsule, and sometimes, on the contrary, it floats, according to the degree of concentration of the solution. The solution being poured off, an oily matter remains, which soon concretes by cooling.

The crude acid thus prepared is hard, brittle, of a slight yellow colour, and contains a notable quantity of benzoic acid. It is freed from this by repeated solutions in boiling distilled water; and the purification is eventually completed by repeated crystallizations in alcohol, or in a mixture of alcohol and ether.

The benzoic acid separated in this manner is added to that which the decanted liquor contains, which is then strained through a cloth and washed with cold water. It is to be carefully pressed; and by treating it in a capsule with a small quantity of hot water a fresh and often considerable quantity of the new acid is separated, which had been dissolved during the first separation.

The pure acid consists of granular crystals of a cauliflower form. When examined by the microscope they present the form of four-sided acicular prisms. It melts at 302°, and when melted its density is 1.29. It boils at 270° F. It volatilizes without decomposing, and is deposited during distillation on the sides of the vessel in flat needles of a greasy lustre, and grouped around a common centre.

Its odour, especially when it has been melted, is sharp and penetrating, like that of all chlorinated compounds in general, but entirely different from that of the acid from which it is derived.

Analyses showed that it was composed of:—

C^{24}	72	50.00
H^{10}	5	3.47
Cl^{2}	35	24.30
O^{4}	32	22.23
	144	100.00

When chloroniceic acid is treated with fuming sulphuric acid, they combine so as to form with barytes a soluble salt, probably represented by

$2SO^3$, C^{24} H^8 Cl^2 O^3, BaO, H^2 O, like the corresponding sulphobenzoate.

When distilled with lime or barytes, with proper precautions, two hydrocarburets are formed; the first is liquid and the second solid. It resists long-continued exposure to the action of dry chlorine, even under the influence of heat, and also the dechlorizing action of the amalgam of potassium.

ON THE NATURE AND COMPOSITION OF VARIOUS CHLORONICEATES.

Chloroniceate of Ammonia.—When freshly prepared by the direct saturation of [chloro ?] niccic acid dissolved in alcohol [chloro ?], niceate of ammonia crystallizes in large micaceous laminæ, which undergo change by the action of light, becoming brown and acid to litmus paper. When pure, this salt is fusible and volatile, without undergoing decomposition. By analysis it appeared to be composed of—

C^{24}	72	44.72
H^{16}	8	4.96
Cl^2	35	21.73
O^4	32	19.90
Az^2	14	8.69
	161	100.00

Chloroniceate of Barytes.—This salt is a white crystalline powder, which is slightly soluble in water, but readily so in hot alcohol. It is decomposed by heat, yielding a mixture of two hydrocarbons, one solid, the other liquid; and a coaly residue is formed. It appears to be composed of—

C^{24}	72	34.12
H^8	4	1.89
Cl^2	35	16.58
O^4	32	15.19
Ba	68	32.22
	211	100.00

Chloroniceate of Silver. — When prepared in the usual manner in alcoholic liquors, this salt is precipitated in the form of white flocculi, which washing and drying convert into a crystalline powder. By analysis it yielded—

C^{24}	72	28.68
H^8	4	1.59
Cl^2	35	13.94
Ag	108	43.02
O^4	32	12.77
	251	100.00

Ann. de Chim. et de Phys.

ANIMAL ELECTRICITY.

By ROBERT HUNT, Esq.

Considerable attention has been called, particularly in France, to some experiments of M. du Bois Reymond, which appear to show that the needle of a delicate galvanometer may be deflected by some effect of muscular energy. As the results involve many important considerations, it will be the most correct course to describe exactly the original experiment.

Two plates of platina of the same size are connected with a delicate galvanometer. Two glasses are filled with a solution of salt and water. Everything being so arranged that no external agitation can disturb the needles — the two platina plates are placed one in each glass—the muscles of one arm are now excited in such a manner as to develop their full power, and then the index finger of each hand is plunged into the fluid in the glasses. "With my galvanometer," says M. du Bois Reymond, "the deviation of the galvanometric needle amounts to 30°. I obtain, however, much more extensive movements of the needle by contracting alternately the muscles of one and then of the other arm." M. de Humboldt states, in his letter of the 17th of May to M. Arago, that, notwithstanding his great age, the deviations of the needle when he has tried the experiment have been very great. I have carefully repeated the experiments of M. du Bois Reymond; but I have succeeded in obtaining a good result only when I have firmly grasped one of the plates of platina, and brought the index finger gently in contact with the other. In this way the needles of a galvanometer, which is not remarkably delicate, were deflected at different times from 20° to 30°. There are some points in connection with these experiments to which I am anxious to call attention. M. Despretz and M. Becquerel made on the 28th of May communications to the Académie des Sciences de Paris on the above subject, and they appear disposed to refer the effect produced to some of the disturbing agents, chemical or thermic, with which we are acquainted. A few careful experiments appear, however, to prove, that, although both heat and chemical action may produce results which tend to complicate the phenomenon, they can be eliminated, their errors avoided or allowed for, and the fundamental fact brought out with clearness. The following were the experiments which I tried, the galvanometer and the wires connected with the platina plates, which were three inches long and one and a half inch wide, being secured firmly to a table.

1. Two glasses, containing salt and water in the proportion of four ounces to an imperial pint, were prepared, and the platina plates placed to the depth of two inches in the fluid. The muscles of the right arm being powerfully contracted, the index finger of each hand was plunged into the saline solutions. A tremor was produced upon the needle; but on no occasion could I succeed in obtaining a deviation of more than 2°. Several friends, one of them a gentleman of great muscular energy, tried the experiment, but they did not succeed in producing a greater deflection.

2. A basin was substituted for one of the glasses, and the whole hand was plunged into the liquid, but there was no greater deflection. It is evident from this that the extent of animal surface which is placed in the fluid does not alter the result. But upon grasping the platina plate and holding it firmly, pressing it with the fingers against the palm of the hand, the needle was immediately deflected 12°; and upon loosening and resuming the grasp, as the needle returned to its zero point, the deflections arose to 25°. After this they gradually lessened, until, notwithstanding the greatest exertion, they did not pass 8°. As all the conditions remained the same, this reduction in the current can be referred only to a loss of power in the muscles.

3. Thinking it probable that the mechanical exertion developing an increased amount of heat might have given rise to thermo-electric currents, I substituted a hot solution on one side of the arrangement, still keeping the other cold. The connection was made by the fingers between the two, but with no increased action on the galvanometer; and even when a piece of wet cotton was placed across the basin and glass, from the hot to the cold fluid, the permanent deflection was only 2°. When the hand was plunged in the basin containing the hot solution, and the platina grasped firmly, the deflections varied from 12° to 25°. When the hot water was in the glass, and cold in the basin, and the contractions energetically made, I, however, succeeded in obtaining a deflection of 33°. These results prove that the result is not due to any thermo-electric action.

4. With the view of ascertaining if chemical action produced upon the surface of the plates had anything to do with the development of electricity in the circuit, plates of zinc and of copper were substituted for platina. After the first deflection of the galvanometer, arising from the surface action at the moment of immersion in the brine had subsided, and the needle returned to its zero, the experiment was repeated as before, and in every case the deflections produced by muscular contraction were less than those exhibited when platina plates were employed.

As I have already remarked, many sources of error present themselves in experiments of so delicate a nature as the above; but it does not appear that we have indications of electrical disturbances which are not due to ordinary thermic or chemical action, and which depend upon the mechanical force employed in the muscular power exerted. M. Desprets says "the necessity for multiplying experiments is evident; since we find the results of two or three experiments confirming those of M. du Bois Reymond; and again two or three contradicting them." The necessity for carefully repeating the examination is imperative; but, as far as my brief investigation has gone, I am disposed to consider the opposing results observed by M. Desprets as due to the exhaustion of muscular force after the first experiments have been made—as repeatedly the deflections from 20° have fallen back slowly to 5°, and sometimes, notwithstanding violent efforts, even to zero—whereas, after the arm has been rested for a few hours, the original deflection has been again established. The question bears too importantly upon the entire phenomena of animal electricity to be hastily dismissed, and it will, without doubt, receive a searching examination.

ON THE REACTION OF SULPHATE OF POTASH AND SULPHATE OF COPPER.

By M. J. PERSOZ.

When a saturated solution of sulphate of potash containing some sulphate of copper is made to boil, it becomes in a very short time extremely acid, and yields a very dense precipitate, which adheres to the bottom of the vessel, and causes so much bumping that it is requisite to use a porcelain capsule.

In the first experiment 210 grms. of sulphate of potash were dissolved in 1.5 litre of water; and 150 grms. of sulphate of copper in 1.2 litre.

These solutions, previously filtered, were mixed, and the solution was kept boiling for an hour, and then suffered to cool; then, having poured off the acid liquor, and washed the triple salt formed till the washings ceased to be acted upon by ferrocyanide of potassium, the salt was pressed between folds of blotting-paper, and dried in a stove at 212° F. This triple salt weighed 9.95 grms.

The second experiment, made with the same proportions of the salts, but with less water, yielded 27.25 grms. of triple salt.

Lastly, a third experiment was performed, in which 210 grms. of sulphate of potash were dissolved in 1.2 litre of hot water; and, when made to boil, 155 grms. of crystallized sulphate of copper were added in small portions to it, so as not to reduce the temperature. In a quarter of an hour an abundant precipitate of the triple salt was obtained, which, washed with cold water, expressed, and dried by the water-bath, weighed 56.7 grms. When the sulphate of potash is added to the sulphate of copper, the same quantity of precipitate is not obtained.

It results from the above-stated experiments that the quantities of the triple salt vary according to the proportions of water, and whether the sulphate of copper is added to the sulphate of potash or the reverse. When the proportion of sulphate of potash is increased a larger quantity of the sulphate of copper is decomposed, but without in any case obtaining bisulphate of potash and the triple salt only.

As the proportions of the triple salt thus formed are variable, it is natural that the solutions which yield it should differ in composition; some are found to contain much of the copper salt, whilst in others the sulphate of potash is in excess.

On subjecting these solutions to careful evaporation, crystals of a double salt,

$$\ddot{S}\,Cu\,\ddot{S}K + 6H^2\,O,$$

are formed, which by two or three successive concentrations separate completely. It is a curious phenomenon to observe such very soluble salts produced so perfect by simple crystallization. The mother waters eventually resulting

from these crystallizations are merely bisulphate of potash.—*Ann. de Chim. et de Phys.*

THE CHEMICAL TIMES.

SATURDAY, JUNE 16, 1849.

THE CHOLERA.

The Asiatic cholera rages at present with extraordinary virulence in Paris, carrying off upwards of six hundred victims day after day. In Petersburg, Presburg, and other continental towns it prevails with almost equal violence. Ere long it will make its appearance in London, and it will then be clearly demonstrated that the distemper which reigned in our metropolis up to April last, and which, in the course of about forty weeks, carried off only 1,000 persons, out of a population of two millions, was *not* the true Asiatic cholera, but simply a somewhat severe form of the common English cholera, induced in most cases by bad and insufficient food, and confined in its ravages to the poorest and most miserable quarters of the town. The unfortunate children who died at the Tooting farm were not the victims of cholera, but of a general debility of the frame, caused by a species of nutrition very much akin to starvation. This opinion was expressed at the time by Mr. Rose, a surgeon of some experience: had it prevailed, as it unquestionably ought to have, the master of that horrible establishment would not have been permitted to escape from justice under cover of a mere legal quibble.

When the *true Asiatic* cholera shall make its appearance amongst us, then it will be seen how little the disease which prevailed in London up to April last deserved the name of cholera. Against the ravages of the latter scourge the precautionary and preventive measures adopted or recommended by the Board of Health will prove but a very ineffectual bar, and neither the palace nor the hovel will be exempt from its visitation.

Dire experience has at last begun to teach the leading continental physicians that the Asiatic cholera is what we should feel inclined to call "electric" in its origin and nature. M. Andral has come to the conclusion that its prevalence in any locality is owing entirely to the absence of positive electricity in the air of that locality. The head physician of the French army in Africa, Dr. Pallas, of whose excellent work on electric insulation as a curative agent in many diseases an abstract was published in the pages of the *Pharmaceutical Times*, has for years held the opinion that most diseases are distinctly referable to a certain electric condition of the atmosphere; and he has had recourse with the most astounding success to electric insulation as a curative agent in intermittent fevers, cholera, rheumatism, epilepsy, and many other diseases.

In another part of this number will be found a paper on the electric condition of the human frame, in reference to epidemic and other diseases, which will sufficiently show that one of our own countrymen, Mr. Franklin Coxworthy, has not alone long entertained the same opinions with these distinguished authorities, but is even considerably in advance of them. The views which this gentleman propounds on electricity in general, and on electric condition in connection with heat, crystallization, meteorology, evaporation, magnetic condition of the earth, gravitation, chemical affinity, &c. &c., are of a most startling nature, and deserve the serious consideration of the scientific world. For the present we must content ourselves with this passing allusion to Mr. Coxworthy's new theories: we intend shortly to examine them more closely and to discuss their scientific value in our pages, particularly in reference to cholera and other epidemic and periodical diseases.

HANWELL COLLEGE FETE CHAMPETRE.

[From the *Lady's Newspaper*, June 9.]

We were highly gratified on Friday, the 1st instant, by a visit to this delightful spot, and had certainly no idea that there was a possibility of so completely turning a school into a large family circle as we witnessed on this occasion.

Most of our readers are probably aware that the village of Hanwell is charmingly situated, about seven miles from the metropolis, and is a station on the Great Western Railway. The first feeling of a stranger on arriving at the station is one of admiration as he surveys the beautiful church. The next feature in the prospect is the Collegiate School, finely situated in its own grounds of fifty acres in extent. On our approach we were most agreeably struck with the exhilarating sounds of music from a band placed upon the lawn, to which a most interesting group of young ladies (sisters and friends of the pupils of the college) were listening, whilst the parents were promenading with their children around.

Another group were surrounding the natural philosophy professor, who was just raising a balloon for their amusement, which went up in the midst of cheers happy schoolboys only know how to give.

We were most cordially welcomed by the principal, who conducted us round the establishment; and, if we had been gratified by the exterior, we were not less so by that which we saw within.

There seemed to be everything united to infuse a sound literary and scientific education. A series of extensive collections in natural history, tending to lead the mind from a study of the works of nature to that of the great intelligence whence all originates; whilst a large assortment of philosophical apparatus enables the students to carry out a knowledge of every branch of experimental science. But we confess we were most of all interested in the exhibition of the pupils' own industry which surrounded the walls of the school-rooms. Military plans, architectural designs, painting in water colours, proved that this department was under careful superintendence; whilst the beautiful specimens of writing were highly creditable to all parties interested. The piles of books, in which the mathematical and classical exercises were entered, showed us very clearly that, although there was every desire to make the young people happy, *industry* was deemed one of the most efficient means of producing this effect.

The playground, the gymnasium, &c. &c., are all excellently adapted for their purpose; and we were much pleased with the neatness and order of the dormitories, and the domestic arrangements generally.

The festivities were kept up by the younger party in music and dancing until a late hour; and we never remember to have seen a greater number of happy young faces than were assembled on this occasion. It was the sixteenth anniversary of the arrival of the principal at Hanwell; and we can assure him that, whilst we wish him long life, and prosperity, and success to his zealous exertions in the cause of the rising generation, the gala day of the glorious 1st of June will long be remembered by us with pleasure.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL INSTITUTION.

On Saturday, the 2d instant, the fifth lecture of Professor Faraday's course was delivered at the Royal Institution, and it was more fully attended than any of the previous ones. The property of induction was again the principal subject, comprising the phenomena of the electrophorus and the Leyden jar.

In the first place, Professor Faraday explained more fully than in the preceding lecture the cause of electricity emanating more rapidly from points than from flat surfaces. When a metallic point is fixed to the prime conductor of an electrical machine, the electricity which was diffused over the hemisphere at the end of the cylinder is concentrated within the much smaller space of the point, and in proportion to its condensation is its disposition to communicate with neighbouring bodies, and thus to become dissipated. The action of the apparatus called a condenser of electricity is explained by the property of induction. The condenser consists of two circular plates of brass mounted perpendicularly on stands, so arranged that the surfaces of the two plates can be brought close together. One of the plates of metal is mounted on a glass pillar to insulate it from the earth, and is connected with a delicate gold leaf electrometer. Both plates are placed as near as possible without touching, and when in this position an electric (very feebly excited) may be brought in contact with the insulated plate, and no divergence of the gold leaves be perceived; but when the other plate is withdrawn the electrometer is strongly affected. In this case the electricity communicated to one plate induces electricity of the opposite kind on the surface of the other plate, but in their close proximity the two electricities neutralize each other, and no effect is apparent until the plate in connection with the earth is removed and leaves the electricity in the insulated plate free to exert itself. If a solid non-conductor, such as a pane of glass, be interposed between the two metal plates, the effects become more remarkable; it is a condenser of this kind that constitutes the principle of the Leyden jar. The arrangement of the apparatus with a pane of glass having been made, one of the plates was charged by the electrical machine, and loud discharges took place equal to those of a Leyden jar.

The discovery of the Leyden jar occurred accidentally in the middle of the last century, when making the attempt to confine electricity in a glass bottle filled with water. A nail passed through the cork into the water, and when M. Cunæus, a native of Leyden, held the bottle to the machine, and afterwards touched the nail, he received a shock which greatly alarmed him. The extraordinary sensation excited great terror, and the accounts given by philosophers of the effects produced by the discharge of very small jars are curious and entertaining, and afford, as Mr. Faraday observed, a caution against allowing the imagination to exaggerate facts. M. Muschenbroek, who tried the experiment with a small drinking glass, described himself as having been struck in his arms, shoulders, and breast, so that he lost his breath, and was two days before he recovered from the blow; and he added, that he would not take a second shock for the whole kingdom of France.

Bottles filled up similarly to those of the first experimenters with the Leyden jar were exhibited, and in charging one of them Professor Faraday received a smart shock, which made him start, for he said, that with all his experience he could not bring himself to stand the shock of a Leyden jar without starting and feeling annoyance at the convulsive action of

the muscles which it produces. Several experiments were shown for the purpose of illustrating that the coating of a Leyden jar acts as a conductor of the electricity which is induced in the glass. A glass was so contrived that the external and internal metal coatings could be removed after having been charged, and when they had been taken out, and other metallic coatings had been substituted for them, the glass retained its charge of electricity. In other experiments the brass knob and connecting wire of a Leyden jar, after it had been charged, were taken out, and in this state the jar manifested no trace of electricity; but, when the interior connecting wires had been replaced, the approach of the discharger produced a loud report. The effect of a combination of Leyden jars to form an electrical battery was shown by a discharge of a battery consisting of fifteen large jars through a slip of gold paper, the gold of which was partially dissipated, and the report nearly equalled that of a pistol.

The property of induction on which the phenomena of the Leyden jar depend is curiously exemplified in the electrophorus. A flat cake of rosin being excited, a plate of brass insulated by a glass handle, when pressed against the rosin and touched, and then removed, will continue to give sparks for a long time without further excitement of the rosin; the effect being caused by the induction of electricity in the brass through the thin stratum of air interposed between the rough surface of the rosin and the brass plate.

SOCIETY OF ARTS.

On Wednesday evening, May 30, a paper was read at the society's rooms illustrating an electric telegraph, invented by Mr. E. W. Siemens, of Berl n, and now in successful and constant operation on numerous lines of communication in Germany. The inventor's brother, Mr. C. W. Siemens, was present, and fully explained the instrument and its mode of working. Two or three diagrams were exhibited demonstrating the internal machinery; and working models of the invention were also placed upon the table, and referred to in exemplifying its operations.

One advantage of this telegraph consists in the small amount of electricity required for its working; this is effected by breaking the current in each instrument before the attraction of the armature of the electro-magnet is completed; but, although a small amount of battery power, or a defective current, is able to work the instruments, yet the more intense the supply of magnetism the quicker they work; and are not dependent upon a certain fixed quantity of electricity.

In all electro-magnetic telegraphs hitherto invented, the break and restoration of the current—which causes the telegraph to work—is effected by means of movements of hands or clockwork; the speed wherewith these successive breaks and restorations of the current follow one another, and also the duration of each current, is independent of the amount of the working power, and of the resistance of the apparatus.

In a mechanical point of view, all former telegraphs may be compared to the first steam-engines; when the steam-valves were worked by hand, and not by the machines themselves.

The principal feature in Mr. Siemens's invention consists in breaking and restoring the galvanic current by the electro-magnet itself, at the moment when the vibration or movement of the armature to the one or the other side is ended. This constitutes it a self-acting machine, its speed being dependent on the amount of the acting power (*i.e.*, the galvanic current), and which, when put in motion, continues to work until arrested by the prevention of the current being restored. Increased certainty and unison of motion is hereby obtained, thus rendering the instrument more easily manageable, and, at the same time, freer from all hindering influences.

When a galvanic current passes through the coils of the magnets, the armatures are attracted by their poles, and, consequently, turned, to a slight extent, upon their spindles. The armatures are affixed to a lever or arm, at the end of which is a hook. This hook catches in the teeth of a cogged wheel (containing the same number of teeth as there are keys upon the dial-plate); when, therefore, the armature is attracted and turned by the magnet, the lever, being moved, draws down the hook, and so turns the wheel until it is arrested by another hook, its duty being to stop it while the other spring is passing one tooth. Placed on a pivot in the centre of a circular dial-plate is a hand or indicator, surrounded by keys having the different letters of the alphabet marked on their surfaces, which converge to the centre. These keys are sustained in their position by separate springs. Beneath each key and spring is a peg, which, on the key being pressed, is forced down, and prevents a lever inside from passing. This lever runs underneath the dial-plate parallel with, and is fixed to the same centre as, the hand or indicator. Therefore, when this lever is arrested by a depressed pin, the hand above must necessarily point to the same key which depresses the pin. The hand of the opposite instrument must likewise point to the corresponding key, because, the magnetism being broken off by the time, or just before, it accomplished its arrival at that letter or key, there is no power left for its moving until the depressed key in the opposite instrument resumes its natural position, and allows the current to be re-established. A lever, which Mr. Siemens calls the commutator, is placed on the outside of each instrument, at a little distance from the dial-plate and keys; this lever, when the telegraph is not in use, is at the position of rest. When the correspondent at one station wishes to make a communication he moves the commutator in his instrument from rest to the opposite side, called telegraph. The movement connects the circuit (or, to speak more explicitly, but less scientifically, turns the electric power given off by the battery into the coil of the magnet, and enables it to attract the armature), and rings the bell at the opposite station.

The telegraph being self-acting, when the magnetism is turned on either the telegraph part of the instrument is set in motion, or the bell must ring—each depending on the position of the commutator.

The bell thus being set in motion will continue to ring until the attention of the correspondent is called to his instrument; then, by turning his commutator from rest to telegraph, the magnetism is sent from the bell into the instruments; the bell, of course, ceases to ring, and the hand above, together with the machinery underneath, is set in motion.

The sender of the message ascertains by his own instrument when the correspondent's commutator is turned, for the magnetism being sent through both instruments, the hands on the dial-plates, by the operation of the interior working of the telegraphs, are immediately and simultaneously set in motion, and must, of necessity, be spontaneous in their action, because the magnetism in each instrument is broken and restored at the same instant,

That the hands may exactly correspond in each instrument there is an understanding between the correspondents that the hands or indicators on the dial-plates shall point to a specified blank key before the communication is commenced. Each, then, turns his commutator from telegraph to rest, and if they find the hands, on the telegraph stopping, are not opposite to this key, they individually, by a mechanical movement, situated a little below the keys, and having connection with the interior works, can bring the indicators to that key. This being accomplished, both return their commutators to the position of telegraphs, and the message is sent.

The instruments are inserted horizontally into a writing-desk, and can be readily worked by the left hand, the right being at liberty for writing down memoranda. Should either of the correspondents, for the sake of noting down a message, or otherwise, require a pause in the communication, he can, by placing his finger upon the top of a button, inserted in the centre on which his commutator turns, arrest the working in both the instruments, thus cutting off the supply of the magnetism for as long a period as he may require.

A telegraph on this principle, between Gross Bereen and Berlin, has been in successful operation for two years and a half. Another, since then, has been completed between Frankfort-on-the-Maine and Berlin, a distance of 350 English miles.

A better proof cannot be of the certainty of its operations than that all-important debates in the German Parliament are conveyed by it, and published in Berlin by the next morning.

Mr. Siemens has, during the erection of this telegraph, made some important discoveries in insulation, viz., that wire insulated in gutta percha, and suspended in the air, is not free from atmospheric influences; but when sunk in the ground it has never met with any perceptible disturbing causes.

The instruments are now at the General Telegraph Company, John-street, Adelphi, and any one interested in the subject will be amply repaid by an inspection of them.

STARCH MANUFACTURE.

The town of Montrose has been known for many years for the production of this article of domestic use; and we are happy to notice that Mr. John Muckart, of Montrose, starch-manufacturer, has lately introduced an improvement in the process, which promises to be of great utility, and, like most useful inventions, is remarkable for its simplicity. Those acquainted with the ordinary mode of finishing this article are aware that it is subjected to great heat for removing the superfluous moisture, the starch being exposed to the influence of heated air in a close chamber or stove, having large cast-iron flues placed around the floor, and heated to nearly redness by a furnace. It is well known that the starch during this stage of its manufacture is very liable to deterioration in some of its most valuable properties by the effects of very dry radiated heat. The improvement now noticed consists in introducing a current of pure atmospheric air, passing into the stove from under the flue-pipes; and, after being so charged with heat, it ascends into the chamber, and in its passage receives an accession of moisture from a metallic vessel resting on the upper surface of the flues, and constantly charged with water at the boiling point. The current of air so prepared passes to, and pervades, the substance of the starch, which is arranged in parcels of about six pounds each, on tiers of shelves above. The peculiarity of the contrivance is in subjecting the starch to a moist heat, thereby preserving some of the properties of the article, which are otherwise considerably impaired. The apparatus, which Mr. Muckart designates a "hot vapour stove," has fully met his expectations as to its value; and we trust his ingenuity will not go unrewarded.

REAPPEARANCE OF CHOLERA.

[From the *London Gazette* of the 12th instant.]

General Board of Health, Gwydyr-house, June 11, 1849.

The General Board of Health, in a letter addressed to the boards of guardians on the issuing of the order in council bearing date March 27, 1849, for renewing for a further period of six calendar months the operation of the act "for the removal of nuisances and the prevention of epidemic diseases," called attention to the fact, that recently in Scotland, and in various cities and towns on the Continent, Asiatic cholera had again broken out, after it had disappeared for

some time; and they represented the necessity, notwithstanding the general decline of the epidemic in Great Britain, of continuing to enforce every practical measure of precaution and prevention against this disease.

The General Board of Health have continued to watch with anxiety the progress of the pestilence abroad, the similarity of its present to its former course indicating its probable return to its former seats. The identity of that course in past years led the board to apprehend its probable increase in Russia and its return to Holland; and the fear that it might also again reach this country induced the board to recommend the renewal of the order in council, continuing in force the Nuisances Removal and the Diseases Prevention Act. Their apprehension has been realized. It has again prevailed as an epidemic at St. Petersburg; it has returned to Rotterdam; and it is now the painful duty of the board to announce that it has reappeared in this country, having again broken out in various and distant places in England, Wales, and Scotland.

The circumstances under which the disease has reappeared leave no doubt that these local outbreaks ought to be regarded as general warnings, proclaiming the necessity of the immediate and general adoption of every practical measure of precaution, as well on the part of private individuals as of collective communities.

The accompanying summaries show the daily, weekly, and monthly cases of cholera that have occurred in the metropolis, in England and Wales generally, and in Scotland, since the renewal of the order in council, as far as those returns have been made to the General Board of Health; but there is reason to believe that numerous attacks have occurred in different parts of the country, from which no returns have been made to this board.

From these returns it will be seen that since the latter end of March cholera has broken out in twelve different localities in the metropolis, in twenty-seven towns in England and Wales, and in seventeen towns in Scotland; and that in several of these places, as in Sunderland, Liverpool, Durham, Hitchin, Gloucester, Keynsham, Bath, Merthyr Tydvil, Cardiff, Kilbirnie, Galashiels, Kelso, and Dundee, the disease has continued to spread.

Another fact is declared by these returns of great significance, which calls for the earnest attention of the local authorities charged with the execution of the Nuisances Removal and Diseases Prevention Act, namely, that the attacks within the last twelve days have exceeded those which have occurred during the preceding two months.

Thus in the two months, from the 29th of March to the 29th of May, both inclusive, the total number of cases is 428; but within the last twelve days, that is, from the 30th of May to the 11th of June, both inclusive, there have been no less than 673 cases, and at the same time the disease has manifested a decided tendency to spread epidemically, as is shown in the numbers attacked on board the American emigrant-ship at Plymouth, and in the extent to which the disease has prevailed in Glover-hall-court, Beech-street, Barbican, in the City, and also in Bermondsey.

The total number of deaths, up to the time of the renewal of the order in council, were 6,319, out of 14,332 attacks, or in the proportion of three deaths to seven attacks; whereas the returns now made give 638 deaths out of 1,203 attacks, or a proportion of more than one half—a proportion exhibiting the severity that usually marks the commencement of a general outbreak.

Under circumstances which thus afford ground for apprehension that another visitation of the scourge may be impending, the General Board of Health deem it highly satisfactory to be enabled to report the uniform success which has followed prompt and continued attention to the premonitory symptoms which generally precede an attack of this disease. In their first notification on the reappearance of the pestilence in September, 1848, they announced that there was no real foundation for the extent of popular alarm arising from the apparent suddenness of the attack; that except at the first outbreak of the disease in a locality it is the developed stage only that is sudden; and that, in general, distinct warning is given of the approach of the disease in sufficient time for the employment of effectual remedies against it. Recent experience has fully confirmed the truth of this representation. In Dumfries, Hamilton, Paisley, Glasgow, and numerous other places, special arrangements have been made for the daily visitation of every house in the infected localities, with a view to search out incipient attacks, and to bring all such cases without delay under appropriate dietetic and medical treatment. The success of this measure, wherever it has been adopted, has been so decided as to establish the fact that we have now arrived at the knowledge of an effectual mode of dealing with this pestilence; and the authorities charged with the execution of the Nuisances Removal and Diseases Prevention Act in any place in which cholera may hereafter break out will incur the gravest responsibility if they do not forthwith organize an adequate staff to carry out this plan of visitation in its full efficiency.

The General Board of Health have to regret the failure of any mode of treatment that has been hitherto adopted in the developed or collapsed stage of this disease. They would not discourage efforts to arrest the progress of the malady in this stage; they believe, from information communicated to them, that individuals have been recovered from it who have received from the hands of their medical attendants the unremitting attention which is given to a person in a state of suspended animation; but few can receive such attention when the sufferers are numerous; and the register of deaths in all countries, in all climates, among all ages and classes, and whatever mode of treatment may have been adopted, shows that the only well-founded hope of saving life is by prompt and continued attention to the very first indications of an attack.

Recent experience has fully confirmed the evidence previously adduced that the localities of this disease and the localities of other epidemics are the same, not a single instance having come to the knowledge of the board of the spread of this scourge in groups in any other than the ordinary seats of typhus and other zymotic diseases, those seats being uniformly marked by the existence of filth, bad ventilation, overcrowding, and other local causes of atmospheric impurity. This is so certain and constant as to afford stronger grounds than ever for the presumption of culpable ignorance and neglect wherever successive cases continue to occur in any locality, or wherever the disease widely spreads through a court, street, or district.

Recent experience further establishes the advantages that have resulted from the operations of cleansing. The first cases of cholera that occur in a locality are sometimes sudden, without any premonitory symptom; this suddenness of attack is in itself evidence of the local presence in unusual intensity of the causes of atmospheric impurity. As soon as cleansing operations have been carried into full effect these sudden cases cease, and instead of them diarrhœa appears, which, if promptly and properly treated, does not pass into cholera. Uniform experience shows that the first and certain effect of these cleansing operations is to stop these sudden attacks; and the cases of premonitory diarrhœa that follow, if early and properly attended to, are, in the great majority of instances, arrested at once; and thus the extension and the great mortality of cholera are checked.

The proportion of deaths to attacks already stated shows that the severity of the disease itself, wherever it actually breaks out, is as great as at any former period, if not greater; and a strong presumption arises that, but for such exertions as have been made, the general visitation would be equally severe, as it still is in those localities of the towns and cities of Egypt, Russia, and other places, where no sanitary improvement has been effected.

The General Board of Health have to renew their former representation, that what is done against this one disease will have been done against the entire class of epidemic diseases. It is scarcely possible to over-estimate the importance of the conclusion to which the whole tenor of recent experience leads, that, in proportion to the intelligence and energy exerted for the removal and prevention of the localizing conditions on which the presence of this disease depends, it is practicable in a great degree to secure immunity from it, and that, if happily cholera should not again prevail to any great extent, those exertions will be equally effectual against typhus, scarlet fever, diarrhœa, and other native and prevalent epidemic, endemic, and contagious diseases.

By order of the General Board of Health,
HENRY AUSTIN, Secretary.

HEALTH OF LONDON DURING THE WEEK.—The present return of 971 deaths exhibits an increase of nearly 80 on each of the two preceding weeks, and also a small increase of 8 on the average of five springs. The mortality from diseases of the respiratory organs continues to decrease, for the numbers in this class in the last three weeks were successively 139, 127, and 102, while the average is 131. The increase is principally in the zymotic or epidemic class of diseases; for whereas the average is 198, the deaths in this group, in the same three weeks, were successively 233, 209, and 251. The deaths in the last week from diarrhœa and dysentery were 25, or 11 above the average, but are not more numerous than in the same week of 1848; those from cholera in two preceding weeks were respectively 5 and 9, but in last week were 22, though the weekly average in former years was only 1. Hooping cough shows an excess on the average of 22, the number in this return being 58. The deaths from scarlatina were 40, or 8 more than the average; those from typhus 38, of four less than the average. In the West London workhouse a man of 36 years died of "low fever accompanied with diarrhœa, apparently produced by extreme destitution." Another man of the same age died of "delirium tremens, brought on by excessive drinking." In University College Hospital the death of a juggler, 22 years of age, occurred, according to the return, from "tremendous pericarditis, caused by passing an iron sword down the œsophagus and thence to the pericardium, after exhibition." Inquests were held on the above three cases. Respecting a death at Bermondsey, Mr. Martin, the registrar, states that "the boy died of cholera, and because the medical attendant, amidst other remedies, ordered the free exhibition of cold water the child's uncle demanded an inquest, which was held this day. The case occurred in a house overhanging the filthy and disgusting tidal ditch. Other cases have occurred on the same spot, two of which have proved fatal this day, but are not yet registered. The jury expressed in no measured terms their opinion of the commissioners, who, having recently had the opportunity of purchasing the tidal ditch, and the power of closing up the present large open drain, refused to do so from a trifling pecuniary consideration, leaving the thousands of persons who reside upon its banks to suffer from the pestiferous effluvia constantly arising therefrom."

COMMISSION OF SEWERS.

The usual meeting of the commissioners took place on the 12th inst. at Guildhall; Mr. Deputy Peacock in the chair.

HEALTH OF THE CITY.

Dr. Simon, the medical officer, read a report from which we extract the following paragraphs,

which are of deep interest at the present moment:—

"The mortality of the last week includes several deaths attributable to the epidemic influence of cholera. Their number is not in itself large, yet it exceeds the total amount of cases reported in the previous nine months during which the disease has prevailed here. In proceeding to state the circumstances under which these cases have occurred, I feel satisfied that the court will observe how exactly this outbreak of cholera fulfils the prediction which I ventured to make in my report of January 23. The present eruption of the disease has taken place chiefly in Glovers'-hall-court, Cripplegate, a spot not only deficient in drainage, but possessing other conditions favourable to the development of epidemic disorders. The cellars generally were in a filthy state; and particularly in the house No. 5 (where the inmates have suffered most severely) the accumulation of offensive material in the cellar was such as to reduce it pretty nearly to the condition of an ordinary cesspool. In the room immediately over this cellar four cases of cholera have occurred, two of which proved fatal. On the higher floor two cases occurred, both fatal. Cases have likewise arisen in three other houses of the court, four houses out of six being now infected. These other cases, as well as the survivors at No. 5, continue, at present, under medical treatment. Three cases are still considered by the visiting surgeon to be in imminent danger. I have, of course, not thought it expedient to wait for the meeting of your honourable court, in order to institute the requisite measures of cleansing and deodorizing this filthy locality, and the inspector of the district will report to you how far those measures have been accomplished. At No. 5, Whitecross-street, two cases have occurred, one of which was fatal, the other terminated in recovery. This house is not defective in general cleanliness, but the lower portion of it is devoted to the preparation of cats' meat, and the residents describe as an intolerable nuisance the pollution which their atmosphere constantly undergoes from the cookery of putrid meat. In the registrar's returns these cases are spoken of by the name of diarrhœa or malignant diarrhœa, for, in the exercise of a wise discretion, the medical gentleman in attendance has refrained from giving them the more alarming title. I may inform you, however, that he has no doubt as to their having been cases of genuine cholera; and I may add, likewise, that it matters very little what name is given to an epidemic disease tending to prove fatal in a very few hours, by totally prostrating the vital powers of a person previously in average health."

Application had been made to the three boards of guardians in the City, soliciting that some competent person, sent from the office of the commissioners of sewers, might be allowed once a week to attend at the office of the unions for the purpose of transcribing certain parts of the tabular record of cases under medical treatment. With this request the City of London and the West London boards complied immediately, but the guardians of the East London Union refused to accede to it. The consequence was, that though information was given to Mr. Baylis, the clerk of the union, with respect to the Glovers'-hall-court cases, on Saturday, June 2, no communication reached the Court of Sewers till Thursday; when three deaths had occurred, and when several other persons were infected by the disease. Mr. Simon expressed his conviction that, if the report had been transmitted to the court at an earlier period, the result, in all human probability, would have been different; and that in the question of the cordial co-operation of those boards with the court there was involved a large stake of human life—that if their co-operation was withheld human life would inevitably be sacrificed. The court was requested to consider whether the existing staff of inspectors was sufficient in number for the present emergency. The report concludes as follows:—

"Without hazarding an opinion on the future progress of the epidemic, I would remark that its non-extension to other quarters of the City within the last few days may have depended on the sudden fall of temperature which occurred last Saturday, and cannot be considered as an indication that those other courts, if in an unhealthy condition, will enjoy any future immunity from the disease. At all events, I would recommend that, within a week from the present time, all habitations hitherto reported as unclean should be subjected to re-examination, and, where the necessary cleansings shall appear not to have been accomplished, that they should at once, and peremptorily, be enforced."

MISCELLANEA.

SPECIFICATION OF PATENT RECENTLY ENROLLED.

William Bullock Tibbits, of Bramston, in the county of Northampton, gentleman, for improvements in obtaining, applying, and controlling motive power; parts of which improvements are applicable to the raising and forcing of liquids. Patent dated November 2d, 1848; enrolled May 2d, 1849.

This specification describes the construction of a rotary steam-engine; a paddle-wheel with vibratory or movable floats; breaks to be applied to the wheels of railway carriages; and apparatus for raising and forcing water or other fluids. The rotary steam-engine consists of a drum or cylinder, mounted upon a shaft or axle, and revolving within an eccentric case; the interior surface of the case gradually receding from the surface of the cylinder or drum. Four leaves or flaps are placed upon the surface of the drum; they are attached by hinges, so that the flaps, by being caused to move outwards, will always press against the interior surface of the case. When the flaps are closed against the drum (which takes place while passing the point of contact between the drum and the case), then the exterior surfaces of the drum and flaps are flush, and present an unbroken surface. The ingress steam-passage is through one end of the eccentric case; there being corresponding passages through the outer part of the enclosed drum, and which passages terminate under the leaves or flaps; so that, when the steam is admitted through the passages to the interior of the case (which takes place as the flaps have successively passed the point of contact of the drum and case), the flaps are forced outward, and against the interior surface of the case; thereby making the joint steam-tight. Just before completing the entire revolution, the egress steam-passage is situated at the largest part of the case, when the steam leaves the case, and the flaps, from this point to the point of contact, gradually close against the drum for the purpose of passing the point of contact.

The patentee likewise describes a double-acting (the above description being that of a single-acting) engine. The patentee means by "single-acting" that the engine or drum is capable of revolving in one direction only, while the "double-acting" is capable of being made to revolve in either direction at pleasure. For this purpose the drum is provided with two sets of flaps, opening in opposite directions; and two sets of steam-passages, to either of which (the passage of the steam being opened to one set of passages and closed to the other) the drums will revolve in either direction, accordingly. The paddle-wheel described in the specification consists of a wheel, upon which the floats are attached by pivots or axes, situate at the middle of the breadth of the float, upon which they move or vibrate. A ring is placed on each side of the wheel, eccentrically to the wheel; and smaller eccentric rings are also placed, one on the ship's side, and one on the paddle-box; between these eccentric rings the floats are always maintained; there being small friction rollers upon the edges of the floats, which move upon the eccentrics; thus, during the revolutions of the wheel, the floats are continually varying their position.

There are two modes of constructing railway-carriage breaks described, both of which are by employing the axle itself as the fulcrum of power. The first is by employing a horizontal lever to each wheel, the axle being the fulcrum; to this lever the breaks are attached, in such manner that, when the lever is in a horizontal position, the breaks will be off the wheels; but, by either raising or depressing the lever, the breaks will be caused to bear against the wheels. In the second modification the breaks are worked by eccentrics placed loosely upon the axles themselves; a lever attached to the eccentrics being the mode of actuating them.

The patentee adapts the construction of the rotary steam-engine before described, with slight modification, to the purpose of raising and forcing water.

The patentee claims:—First, the peculiar arrangement of the parts described for obtaining motive power. Secondly, the arrangement of paddle-wheels. Thirdly, the modes of constructing breaks of railway carriages. Fourthly, arrangement of apparatus for raising and forcing water, &c.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING JUNE 7TH, 1849.

Moses Poole, London, gentleman, for improvements in brazing, pressing, separating, cleaning, and bleaching, and in cooling or heating matters; also in pistons, valves, taps, and spring apparatus. Patent dated June 2d, 1849; six months. (Communication.)

Henry Trewhitt, of Sunbury-park, in the county of Middlesex, Esq., and Thomas Russell Crampton, of Buckingham-street, in the city of Westminster, civil engineer, for improvements in locomotive, marine, and stationary engines; and also in the connecting apparatus of marine engines. Patent dated June 2d, 1849; six months.

Elijah Slack, of Orchard-street, in the burgh of Renfrew, North Britain, gun-manufacturer, for improvements in the preparation of materials to be used in the manufacture of textile fabrics. Patent dated June 2d, 1849; six months.

William Goose, of Birmingham, in the county of Warwick, manufacturer, for certain improved machinery for manufacturing nails. Patent dated June 5th, 1849; six months. (Communication.)

William Henry Smith, of Fitzroy-square, in the county of Middlesex, civil engineer, for certain improvements in breakwaters, beacons, and moorings; parts of which are applicable to other purposes. Patent dated June 5th, 1849; six months.

George Simpson, of Buchanan-street, in the city of Glasgow, North Britain, civil and mining engineer, for a certain improvement or improvements in the machinery, apparatus, or means of raising, lowering, supporting, moving, or transporting heavy bodies. Patent dated June 5th, 1849; six months.

Samuel Dunn, of Doncaster, in the county of York, gentleman, for improvements in constructing tunnels, and in apparatus to be used for such or similar purposes. Patent dated June 5th, 1849; six months.

Thomas Lawes, of the City-road, in the county of Middlesex, gentleman, for improvements in generating steam, and in the means of obtaining and applying motive power. Patent dated June 5th, 1849; six months.

William Edward Newton, of Chancery-lane, in the county of Middlesex, civil engineer, for improvements in stoves, grates, or fireplaces, and in warming or heating buildings. Patent dated June 5th, 1849; six months. (Communication.)

Thomas Jowet, of Burrage-house, in the parish of Bingley, in the West Riding of the county of York, for certain improvements in the method of stopping power-looms, and preventing injury to

the eloth or fabrie in the eourse of being woven. Patent dated June 5th, 1849; six months.

George Hinton Bovill, of Abchureh-lane, in the eity of London, engineer, for improvements in manufacturing wheat and other grain into meal and flour. Patent dated June 5th, 1849; six months.

Jacques Hulot, of Rue St. Joseph, Paris, manufaeturer of fabries, for improvements in the manufaeture of shirt fronts. Patent dated June 5th, 1849; six months.

Daniel Miller, of St. George's-road, in the city of Glasgow, Seotland, eivil engineer, for certain improvements in the mode of drawing ships up an inclined plane out of water. Patent dated June 5th, 1849; six months.

Victor Hippolyte Laurent, of Franee, engineer, for improvements in looms for weaving. Patent dated June 5th, 1849; six months.

Osgood Field, of London, merchant, for improvements in anehors. Patent dated June 5th, 1849; six months. (Communication.)

Thomas Hornby Birley, assignee of John George Bodmer, the original inventor of eertain improvements in maehinery for preparing, woving, and spinning eotton and wool, an extension of her Majesty's royal letters patent for five years, from 27th day of May, 1849.

Thomas Masters, of Regent-street, in the eounty of Middlesex, gentleman, for eertain improvements in the construetion and arrangement of apparatus for eooking, for heating, and evaporating fluids, and obtaining deeoetions and infusions from eertain vegetable and animal matters; parts of which improvements are applieable to eertain ehemieal proeesses. Patent dated June 7th, 1849; six months.

Edward John Payne, Esq., of Chaneery-lane, London, for improvements in marine vessels, in apparatus for the preservation of human life, and in moulding, joining, and finishing hollow and solid figures eomposed wholly or in part of eertain gums, or eombinations of certain gums; also for improvements in dissolving the aforesaid gums; and in apparatus or maehinery to be used for the purposes above mentioned. Patent dated June 7th, 1849; six months. (Communieation.)

Robert Wilson, of Low Moor Ironworks, Bradford, in the county of York, engineer, for improvements in steam-engines, boilers, and methods of preventing aeeidents in working the same. Patent dated June 7th, 1849; six months.

John Edward Hawkins Payne, of Great Queen-street, in the eounty of Middlesex, eoaeh-laee-manufaeturer, and Henry William Currie, engineer, in the employ of the said John Edward Hawkins Payne, for improvements in the manufaeture of eoaeh-laee, and other similar looped and eut piled artieles. Patent dated June 7th, 1849; six months.

Charles James Anthony, of the eity of Pittsburgh, in the United States of Ameriea, machinist, for eertain improvements in the means of treating unetuous animal matter. Patent dated June 7th, 1849; six months.

William Henry Ritehie, of Brixton, in the county of Surrey, gentleman, for improvements in firearms. Patent dated June 7th, 1849; six months. (Communieation.)

John Houston, of Nelson-square, in the eounty of Surrey, surgeon, for improvements in obtaining motive power when steam and air are used. Patent dated June 7th, 1849; six months.

James Steel, of Horton, in the parish of Bradford, in the county of York, and Benjamin Emmerson, of the same plaee, overlookers, for improvements in power-looms. Patent dated June 7th, 1849; six months.

Gustave François Pieault, of Rue Dauphin, Paris, cutler, for improvements in apparatus for opening oysters. Patent dated June 7th, 1849; six months.

Douglas Hebson, of Liverpool, engineer, for improvements in steam-engines. Patent dated June 7th, 1849; six months.

Henry Knight, of Birmingham, in the county of Warwick, mechanical engineer, for certain improvements in apparatus for printing, embossing, pressing, and perforating. Patent dated June 7th, 1849; six months.

Stanhope Baynes Smith, of Birmingham, in the eounty of Warwiek, eleetro plater and gilder, for improvements in depositing metals and in obtaining motive power, part of whieh improvements are applicable to eertain other similar useful purposes. Patent dated June 7th, 1849; six months.

Bennett Alfred Burton, of the firm of Bennett Alfred Burton and Henry Mortimer Burton, engineers, Solm's-place, Holland-street, Southwark, in the eounty of Surrey, for eertain improvements in the manufacture of pipes, tiles, brieks, stairs, eopings, and other like or similar artieles, from plastie materials; also improvements in maehinery to be employed therein. Patent dated June 7th, 1849; six months.

PATENTS RECENTLY EXPIRED.

J. Nye, Southwark, for improvements in pumps, and instruments or apparatus for eonveying fluids into, or withdrawing them from, eavities of human and other animal bodies, part of whieh improvements are also applieable to other pumps. Patent dated June 2d, 1835; expired June 2d, 1849.

J. Malam, Hull, civil engineer, for eertain improvements in gas-meters, and in the apparatus for generating gas for illumination. Patent dated June 2d, 1835; expired June 2d, 1849.

W. Wilkinson, Middlesex, engineer, for a eertain improvement or certain improvements in the meehanism or maehinery by whieh steam power is applied to give motion to ships or other floating vessels in or through water. Patent dated June 2d, 1835; expired June 2d, 1849.

R. Phillips, Surrey, leeturer, for eertain improvements in the proeess of manufaeturing sulphate of soda. Patent dated June 4th, 1835; expired June 4th, 1849.

J. Leman, Middlesex, gentleman, for the making, mixing, eompounding, improving, or altering of soap. Patent dated June 4th, 1835; expired June 4th, 1849. (Communieation.)

B. Wooderoft, Manehester, gentleman, for improvements in printing ealicos and other fabries, whether manufactured of eotton, silk, wool, or linen, or of all or any two or three of those materials. Patent dated June 4th, 1835; expired June 4th, 1849.

T. Haneoek, Middlesex, waterproof eloth manufaeturer, for an improvement or improvements in air-beds, eushions, and other artieles manufaetured from eaoutchoue or indiarubber, or of eloth or other flexible material eoated or lined with eaoutehouc or indiarubber. Patent dated June 4th, 1835; expired June 4th, 1849.

There is now exhibiting at the Cosmorama Rooms, in Regent-street, a preserved speeimen of a speeies of Gymnotus reeently eaught at Cullereoats, on the Northumberland eoast. This fish belongs to the family of Tæmidæ (ribbon-shaped), only a few of whieh are found in the British seas. A speeimen similar to the present was formerly taken at Elgin; and as the speeies is probably new it has been ealled G. Northumbrieus. The present speeimen is about thirteen feet in length, and has a flat body with a small head and mouth. The dorsal fin extends from the head to the tail. On the erown of the head several of the rays are separated, lengthened, and enlarged, so as to form a kind of erest. This animal was seen floating on the water nearly dead, and when opened it was found to have swallowed a piece of zine, whieh had evidently been the eause of its weak eondition. These fish apparently live on the ground in the deep sea; and the smallness of their mouths, whieh does not permit of their taking ordinary bait, will aecount for their being so seldom seen. This creature has certainly not, as some of our contemporaries seem to think it has, any connection with the sea serpent.

TO CORRESPONDENTS.

☞ The Index which we publish with this number comprises the contents of No. 115 to 140 inclusive. No. 140 finishes the fourth volume. Our subscribers are requested to alter "Vol. *IV.*" to "Vol. V." in the first page of No. 141 *seqq.*

"A Subscriber, Hanley."—The *acknowledgment* per letter of the receipt of five pounds is not *a receipt* in the legal sense of the term, and requires accordingly no stamp.

"Georgos," Grantham.—1. Take a certain weighed amount of the soil or manure, and digest this for an hour or so at a moderate heat in dilute nitric acid (free from the slightest admixture of hydrochloric acid). Throw the mixture on a filter, and to the filtered liquid add potash-water cautiously till the instant that a precipitate begins to appear; then drop into it a weak solution of nitrate of silver. If any phosphoric acid be present a yellowish precipitate will immediately fall, which is resoluble in an excess of nitric acid. Whatever is not thus dissolved is chloride of silver, and ought to be separated by filtration. On adding, then, a weak solution of potash (not ammonia) cautiously to the filtered liquid, the pure phosphate of silver will be obtained without any alumina or iron, provided the liquid be still slightly acid. It should be remembered that chloride of silver falls in a white, curdy form, quite different from that of the phosphate of silver. The portion of soil used for this purpose should be fresh, not calcined, because the phosphates when ignited afford white precipitates with silver. The stronger the solution of the phosphoric saline compound is, the more characteristic is the yellow precipitate with silver, and then ammonia may be used for effecting the partial saturation of the acid in excess. Sulphate of magnesia is an excellent reagent for detecting phosphoric acid, and for separating it from the above-named solution, when it is partially neutralized with ammonia; for the magnesia forms with the phosphoric acid and ammonia the insoluble granular precipitate of ammonio-magnesian phosphate. Another mode of estimating the phosphoric acid consists in digesting the ignited soil in nitric acid, filtering, and precipitating the filtered solution with acetate of lead in excess. If phosphoric acid be present it will produce phosphate of lead mixed with a sulphate of any sulphuric acid which existed in the soil. Wash, ignite, and weigh the precipitate. Digest in nitric acid, decompose the solution with sulphuric acid, add alcohol, throw the mixture upon a filter, and weigh the sulphate of lead remaining on it. From this weight that of the oxide of lead may be calculated 152 of sulphate of lead containing 112 of oxide. The quantity of sulphuric acid formed by nitrate of baryta in another equal portion of the soil being added to the oxide of lead just determined will constitute a sum, which, being subtracted from the weight of the acetate of lead precipitate, will represent the amount of phosphoric acid in the soil. The second question (respecting sulphuric acid) we cannot understand, owing to a word being illegible in our correspondent's letter. If our correspondent will repeat the question, we will reply to it in our next number.

"An Apothecary."—The article is liable to the stamp duty.

"A Dyer, Kennington."—Litmus is prepared in Holland from the Lecanora tartarea, and Rocella tartarea, by a secret process, but which, no doubt, is similar to that for making archil and cudbear, and which is as follows:—The lichens reduced to powder are first treated with a mixture of urine and potass, and fermentation is induced; the result is a purple-red liquid. To this liquid some lime is added, and an additional quantity of urine. The mixture is then set again to ferment for about three weeks, after which it is mixed with chalk or gypsum into a paste, which is subsequently made into little cubes, and dried.

"A Patentee."—The question lies not within our province.

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ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXI.

(LECTURE XCIV.)

VEGETO-ALKALIS—(*Continued*).

BARK—(*Continued*).

PHARMACEUTICAL PREPARATIONS OF BARK.

The French Codex prescribes the use of the pale variety (Cinchona condaminea) for most of the officinal preparations of bark.

The yellow variety (Cinchona cordifolia) is more energetic in its action than the pale bark, and ought accordingly to be substituted for the latter in our Pharmacopœia.

SECTION I. — PREPARATIONS WHICH CONTAIN THE WHOLE SUBSTANCE OF THE BARK.

POWDER OF BARK.

Reduce the bark to powder without leaving any residue.

When operating on pale bark, or any other species of rinded bark, the outer crust of cellular tissue, and the foliaceous or crustaceous lichens which cover it, may either be scraped off previously to pulverization, or the first powder may be rejected. It would not matter much, however, if the whole of the product were used.

When operating. on the other hand, on those species of bark which have no rind, *e.g.*, Calysaya bark, the outer and more friable part is also the most active, whilst the last portions are more charged with inert fibrous matter. The whole of the products are, however, usually mixed together.

LOZENGES OF BARK.

Take of Powder of bark, 10 grammes.
" cinnamon, 1 gramme.
Pounded sugar, 89 grammes.
Mucilage of gum tragacanth, a sufficiency.

Mix, and make into lozenges of 1 gramme each.

Each of these lozenges contains 10 centigrammes of powder of bark.

DESBOIS DE ROCHEFORT'S FEBRIFUGE ELECTUARY.

Take of Powder of bark, 32 grammes.
Carbonate of potass, 4 grammes.
Tartar emetic, 96 centigrammes.
Syrup of wormwood, 96 grammes.

Mix.

This preparation does not act as an emetic. The tannin of the bark decomposes the antimonial salt, and a new compound is formed of totally different properties; no doubt the carbonate of potass may also concur and participate in the decomposition of the antimonial salt.

BOLUS AD QUARTANAM.

Take of Powder of bark, 32 grammes.
Tartar emetic, 80 centigrammes.
Syrup of wormwood, a sufficiency.

F.S.A.

DENTIFRICE POWDER.

Take of Powder of bark,
Porphyrized (vegetable) charcoal, of each equal parts.

Mix.

ANTISEPTIC POULTICE.

Take of Barley flour, 200 grammes.
Water, 500 grammes.
Powder of bark, 32 grammes.

Mix, boil the mixture, remove it from the fire, let it cool down to the requisite degree, and add
Camphor in powder, 4 grammes.

REUSS'S ANTISEPTIC POULTICE.

Take of Powder of bark,
" rue,
Camphorated alcohol, of each 64 grammes.
Take of Camphor, 12 grammes.
Vinegar, a sufficiency.

Mix.

—

SECTION II.—PRODUCTS OBTAINED BY THE ACTION OF WATER UPON BARK.

Bark may be treated either by maceration, or by infusion, or by decoction in water. The products of these divers processes differ greatly from each other.

The liquor obtained by maceration is a weak and very inefficacious product. It contains the kinates of quinine and cinchonine, which salts represent only a proportionately small quantity of the vegeto-alkalis of bark. It contains, besides these salts, also the kinate of lime, the gum, the soluble cinchona red, and the yellow colouring matter. But cold water dissolves only a very minute quantity of the combination of the insoluble cinchona red with quinine; and accordingly nearly the whole of the latter compound remains in the grounds. The maceratum of bark, therefore, is an excellent tonic, but not much of a febrifuge.

The liquor obtained by decoction holds in solution, besides the preceding principles, some starch and part of the sparingly-soluble compound of the cinchona red with the vegeto-alkalis. It contains accordingly a larger proportion of febrifuge principles than the product obtained by maceration.

The decoction of bark is transparent while hot, but turns turbid on cooling, 1st, because the compound of starch and tannin present in the decoction remains soluble only as long as the temperature of the liquid exceeds 120.2 Fahr.; 2d, because the compound of the cinchona red with the vegeto-alkalis, being more readily soluble in boiling than in cold water, separates upon cooling. The decoction of bark is one of the more energetic preparations of that substance. It must be administered turbid as it is, since any attempt at clarifying it would simply tend to remove part of the active principles. The pharmaceutist should bear in mind that even successive processes of decoction fail to exhaust the bark, and that there remains invariably a large proportion of quinine and cinchonine in the grounds.

I have analyzed a deposit formed in the liquors obtained by three successive decoctions of Calysaya bark. I found it composed in 146 parts of sixty parts insoluble in alcohol, and which appeared to consist chiefly of tannate of starch. From these sixty parts I obtained only a few grains of quinine. The other eighty-six parts dissolved readily in alcohol, and I extracted from them eight parts of organic alkali.

The liquors obtained by these successive decoctions of a sample of pale bark were found to contain two thirds of the quinine originally present in the bark: the remaining one third was retained in the grounds. This proportion of one third undissolved to two thirds dissolved is to be considered, however, as only approximate, since it may vary with the respective quantities of water used, and with the respective duration of the process.

The product obtained by the process of infusion contains less quinine than that obtained by decoction. In an experiment which I made with part of the same sample of bark used in the preceding processes, I found that the liquors obtained by infusion contained only one third of the quinine of the bark, and that the grounds retained the other two thirds.

The addition of some acid to the water has for its effect a considerable improvement in the medicinal efficacy of the product. This is readily accounted for by the circumstance that acids possess the property of dissolving the otherwise insoluble cinchona salt, or rather of decomposing the latter and forming soluble compounds with the liberated alkaloids.

The decoction of bark in alkaline liquids gives an apparently richer product than the decoction of bark in pure water, since alkalis dissolve the cinchona red. But at the same time the quinine and cinchonine are precipitated, which circumstance more than counterbalances the advantages resulting from the addition of alkalis to the decoction water.

The ptisan or potion of bark is prepared either by maceration, or decoction, or infusion, according to the effects which it is intended to produce; the dose is from 8 to 32 grammes of bark per quart of water.

For external application the decoction of bark is employed, prepared with 32 to 64 grammes of bark per quart of water. This decoction is used for lotions, fomentations, or injections.

DRY EXTRACT OF BARK.

(*Lagaraye's Essential Salt of Bark.*)

Take of Pale bark, any quantity you like.
Pure water at 77° to 86° Fahrenheit, a sufficiency.

Reduce the bark to a semi-fine powder, and moisten this with one half its own weight of water. Let it stand for about two hours, and pile it then compactly in the displacement apparatus; lixiviate. Evaporate the liquors to syrupy consistence; spread the product on plates with a brush, and dry in the stove. Detach the dry product in scales by means of a knife with truncated blade.

This extract strongly attracts moisture from the atmosphere, and must accordingly be kept in well-closed vessels. The scales agglomerate into masses after the vessel has been opened two or three times. It may be rendered less deliquescent by the addition of 1-20th of its own weight of gum arabic.

According to MM. Pelletier and Caventou's analysis, Lagaraye's extract of bark contains very little quinine. It is, therefore, given rather as a tonic than as a febrifuge. The pale bark contains a larger amount of what may be called extractive matter, and gives a finer dry extract than any of the other varieties of bark.

LOZENGES OF EXTRACT OF BARK.

Take of Dry extract of bark, 10 grammes.
White sugar, 89 grammes.
Cinnamon in powder, 1 gramme.
Mucilage of gum tragacanth, a sufficiency.

Mix, and make into lozenges of 50 centigrammes each.

Each of these lozenges contains 5 centigrammes of dry extract of bark.

SOFT EXTRACT OF BARK.

Take of Pounded pale bark, 1 part.
Water, 6 parts.

Boil for a quarter of an hour, and strain the liquid off. Add six fresh parts of water to the grounds, boil again, and strain. Pour the two liquors together, and evaporate the whole to the consistence of an extract.

SYRUP OF BARK.

Take of Pale bark, 1 part.
Water, 10 parts.
White sugar, 5 parts.

Boil the bark in the water for a quarter of an hour; strain. Evaporate the strained liquid to the extent of one half; add the sugar, and boil to the consistence of a syrup.

Filter the syrup when cold.

30 grammes of this syrup contain the product of 4 grammes of bark.

This syrup prepared with the pale bark, though not perfectly limpid, is yet sufficiently clear not to require filtration. The syrup prepared with the yellow bark is invariably more turbid than that prepared with the pale variety. Yet it is much clearer than the decoction, since the presence of the sugar favours the solution of part of those principles which are insoluble in pure water. Some practitioners prepare their syrup of bark with the infusion instead of the decoction, and with clarified sugar syrup instead of lump sugar. I prefer the syrup prepared with the decoction.

CEMENT.—Mix ground white lead with as much finely powdered red led as will make it the consistence of soft putty.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL INSTITUTION.

The sixth lecture of Professor Faraday's course, at the Royal Institution, was delivered on Saturday, the 9th inst. The various effects of the discharge of electricity formed the subject of consideration, more particularly that form called the disruptive discharge, when the electric fluid forces its way through non-conducting substances. It is this mode of discharge in which the electric force is principally manifested, especially in the phenomena of lightning. When the charge of a Leyden jar is sent through a non-conducting body, such as a card, a burr is raised on both sides of the card, as if the force was exerted from the middle, and acted in opposite directions; and this circumstance was adduced by those who supported the theory of two kinds of electricity as a confirmation of their view; but Professor Faraday said that that theory derives no support from the fact, for experiment has proved that when a solid body is fired with great force through any substance a burr is raised on both sides, in a similar manner to the burr produced by the electric discharge through a card. The disruptive discharge occasions a displacement of the air through which it passes, as was illustrated by sending the charge of a Leyden jar between two wires inside a small cannon, when the cork ball with which the cannon was closed was ejected beyond the table. It is the sudden displacement of the air and of liquids that produces most of the destructive effects of lightning, and not the lightning itself. To show the great force exerted by water, where displaced by an electric shock, the charge of a battery of three jars was sent through a glass tube filled with water, by which the tube was broken in the middle where the spark passed, and the glass was shivered into small splinters in that part. It is in this manner that, when a flash of lightning strikes a tree, the water and other fluids, by their sudden displacement, shatter the wood into splinters. Several specimens of the effect of lightning were exhibited on the lecture-table; among them was a heap of small splinters from an oak which had been shivered by lightning.

Having illustrated the rending power of the disruptive discharge, Professor Faraday proceeded to consider its heating power, and to explain the beautiful variety of forms in which the electric force is displayed, and the varied modes of its action, so that, under different circumstances, its effects are quite different, and such as could not have been predicted of the same power. Gas and powdered rosin have been fired by making the discharge through wires. The professor set fire to either by allowing a spark to pass from his finger, and the experiment was varied by allowing the electric spark to pass from ice to ether, the latter being inflamed in both cases without any indication of heat in the finger or the ice. The different effects of the discharge were shown in a striking manner by operating on gunpowder under various circumstances. When the charge of a jar was sent through gunpowder lying between the ends of the two wires, the grains of gunpowder were dispersed by the shock, but were not inflamed; but when a wet string was made part of the circuit through which the electricity passed the gunpowder exploded. In the discharge in the latter arrangement there was neither spark nor noise, the sudden effect of the discharge having been retarded by the resistance offered to the passage of the electricity by the string. In another variation of the experiment, a strip of gold leaf was made to form part of the circuit with gunpowder placed as before. When the discharge was made through wires the gold leaf was deflagrated, and the gunpowder was displaced without being inflamed; but when the wet string was interposed the gunpowder was exploded, and the gold leaf remained uninjured, the slow discharge not having had sufficient power to melt the metal.

Before the application of the voltaic battery to the explosion of gunpowder in mining operations, the electricity of the Leyden jar had been employed for the purpose very successfully; for, by confining the gunpowder to prevent its dispersion by the shock, or by placing it in communication with a substance more readily inflamed, the explosions would be made with great certainty. Several illustrations of the applicability of common electricity to mining purposes were given; a considerable quantity of gunpowder, placed on a high bracket, was exploded by passing the charge through a wire covered with gutta percha; and a small bladder, filled with an explosive mixture of oxygen and hydrogen gases, was exploded outside the lecture-room by a charge sent through an unprotected wire.

A specimen was shown of the link of a chain that had formed part of the rigging of a ship which had been struck by lightning, which had shattered the chain to pieces, each link having been broken in two in the middle. The heating power of the electric discharge was curiously shown by placing different coins against the coating of a Leyden jar, and making the charge pass through them, when each one remained fixed to the side of the jar; the metals having been actually soldered to each other by the heat evolved in the discharge.

It is owing to the different circumstances of the discharge that the effects of lightning vary so curiously; and it often happens that a powerful flash of lightning will produce less destructive effects than a more feeble one. A lead wire, through which an electric charge had been sent, was melted and dispersed over the paper on which it was placed; whilst a less powerful charge merely melted the metal and small globules of it were left on the paper. Professor Faraday stated that, in one case which had come under his observation, a house had been set on fire by the melted globules of a bell-wire falling on the curtains, whereas, had the lightning been in sufficient force to disperse the metal, the house would not have been fired.

GEOLOGICAL SOCIETY.

Sir C. Lyell in the chair.—A paper was read, "On the Distribution of the Superficial Detritus of the Alps as Compared with that of Northern Europe," by Sir R. I. Murchison.—Referring to his previous memoir * upon the whole structure of the Alps, and the changes which those mountains underwent, the author calls attention to the fact that whilst during the formation of the molasse and nagelflue a warm climate prevailed, so after the upheaval of these rocks an entire change took place, as is proved by the uplifted edges of these tertiary accumulations being surmounted by vast masses of horizontally-stratified alluvia, the forms of whose materials prove that they were deposited under water, and whose vegetable remains indicate that the pine had then replaced the palm upon the adjacent lands. The warm period, in short, had passed away and was succeeded by a cold temperature, before a glacier was formed in the Alps and before a single erratic block was translated. Though awarding great praise to the labours of Venetz, Charpentier, and Agassiz, which have shed much light on glaciers, and particularly to the work of Forbes, for so clearly expounding the laws of the movement of these bodies, Sir Roderick conceives, however, that the physical phenomena of the Alps and Jura compel the geologist to restrict the former extension of the Alpine glaciers within infinitely less bounds than has been assigned to them by those authors. True old glacier moraines may, he thinks, be always distinguished, on the one hand, from the ancient alluvia, and on the other from tumultuous accumulations of gravel boulders and far transported erratic blocks, as well as from all other subsequent detritus resulting from various causes which have affected the surface. He first shows, from the remnants of the old water-worn alluvia which rise to considerable heights on the sides of the valleys, that, in the earliest period of the formation of the Alpine glaciers, water, whether salt, brackish, or fresh, entered far into the recesses of these mountains, which were then at a considerably lower level, *i.e.*, not less than 2,500 or 3,000 feet below their present altitude. He next appeals to the existing evidences in the range of Mont Blanc to show that as each glacier is formed in a transverse upper depression, and is separated from its neighbour by an intervening ridge, so by their movement they have always protruded their moraines across the adjacent longitudinal valley into which they descend, and never formed one grand stream of ice along it. It is stated that there are no traces of lateral moraines on the sides of the main valleys at considerable heights above the present bottoms, whether on the flank of the great ridge from whence the glaciers issued or on the opposite side of each longitudinal valley, which must have been the case if a large mass of glacier ice had ever descended the general valley. On the contrary, examples of the transport of moraines and blocks across such longitudinal depressions are cited from the valley of the Chamonix on the one flank and from the Allée Blanche and Val Ferret on the other flank of the chain of Mont Blanc. Another proof is seen in the ancient moraine of the Glacier Neuva, the uppermost of the valley of the Drance; and a still stronger case is the great chaotic pile of protogine blocks accumulated on the Plan y Bœuf, 5,800 feet above the sea, which have evidently been translated right across the present deep valley of the Drance, from the opposite glacier of Salenoir. Having shown that none of the upper longitudinal and flanking valleys around Mont Blanc were ever filled with general ice-streams, the author has still less difficulty in demonstrating that all the great trunk valleys of the Arve, the Doire, and the Rhone offer no vestiges of what he calls a true moraine; all the detritus from great heights above their present bottoms exhibiting either water-worn pebbles or occasional large erratic blocks, more or less angular—the latter being for the most part irregularly and sporadically dispersed. In descending from the higher Alps into such trunk valleys he found so many examples of rocks finely rounded on the side which had been exposed to the passage of boulders and pebbles, with abrupt faces on the side removed from the agent of denudation, as reminded him forcibly of the storm and lee sides of the Swedish rocks over which similar water-worn materials have passed. Seeing, then, that this coarse drift or water-worn detritus is distributed sometimes on the hard rocks and often on the summits of the remnants of the old valley alluvia, he believes that the whole of the phenomena can be explained by supposing that the Alps, Jura, and all the surrounding tracts have undergone great and unequal elevation since the period of the formation of the earliest glaciers; elevations which, dislodging vast portions of those bodies, floated away many huge blocks down straits then occupied by water and hurled on vast turbid accumulations of boulders, sand, and gravel. To these operations he attributes the purging of the Alpine valleys of the great mass of their ancient alluvia, and also the conversion of glacier moraines into shingle and boulders. He denies that the famous blocks of Monthey opposite Bex can ever have been a portion of the great general left lateral moraine of the valley of the Rhine, as Charpentier has endeavoured to show; and he contends that if such had been the case they would have been associated with numberless smaller and larger fragments of all the rocks which form the sides of the valley through which such glaciers must have passed. They are, however, exclusively composed of the granite of Mont Blanc; and must therefore, he thinks, have been transported in ice rafts, which, having been forced with great violence

* Vide *Chemical Times*, vol. iv., page 270.

through the gorge of St. Maurice, served to produce many of the striæ which are there so visible on the surface of the limestone.* Fully admitting that as the stones and sand of the moraines of modern glaciers scratch, groove, and polish rocks, Sir Roderick Murchison still adheres to the idea he has long entertained from surveys in Northern Europe, that other agents more or less subaqueous have produced precisely similar results. He cites examples in the Alps, where perfectly water-worn or rounded gravel being removed, the subjacent rocks are found to be striated in the directions in which such gravel has been moved; and he quotes a case in the gorge of the Tamina, above the Baths of Pfeffers, where this ancient striation, undistinguishable from that caused by existing glaciers, has, by a very recent slide of a heavy mass of gravel from the upper slope of the same rock, been crossed by fresh scorings and striæ, transverse to those of former date, from which the markings made in the preceding year only differ in being less deeply engraved. He also adverts to the choking up of some valleys, particularly of the Vorder Rhein below Dissentis, by the fracture, *in situ*, of mountains of limestone, which constitute masses of enormous thickness, made up of innumerable small fragments, all of which have been heaped together since the dispersion of the erratic blocks; and he further indicates the effects of certain great slides or subsidences within the historic era. In considering the distribution of the erratic detritus of the Rhone, Sir Roderick, having denied that it can ever have been carried down the chief valley to the Lake of Geneva in a solid glacier, still more insists on the incredibility of such a vast body of ice having issued from that valley as to have occupied all the low country of the cantons Vaud, Friburg, Berne, and Soleure, and to have extended its erratics to the slopes of the Jura, over a region one hundred miles in breadth from north-east to south-west. He maintains that, in the low and undulating region between the Alps and the Jura, the small debris derived from the former has everywhere been water-worn, and that there is in no place the evidence of anything resembling a true moraine, and he therefore believes that the great granitic blocks of Mont Blanc were translated to the Jura, when the intermediate country was under water. He further appeals to the water-worn condition of all the detritus of the high plateaux of Munich, 1,600 and 1,700 feet above the sea, to show that a subaqueous condition of things must be assumed when the great erratic blocks were carried to their present positions. Professor Guyot, of Neufchatel, has endeavoured to show that the detritus of the rocks of the right and left sides of the upper valley of the Rhone have maintained their original relative positions in the great extra Alpine depression, and that these relations are proofs that nothing but a solid glacier could have arranged the blocks in such linear directions. But the author meets this objection by showing that there are notable examples to the contrary on the high plateaux above Vevey, where at heights of 1,600 feet above the Lake of Geneva there are great boulders of Valorsine conglomerate, which must have been transported from the opposite side of the valley of the Rhone. He also refers to the great traînées of similar blocks which preserve linear directions in Sweden and the low countries south of the Baltic, to show that this phenomenon may have been produced by streams of water. In alluding to the drainage of the Isére he further points to the admission of Professor Guyot, that nearly all its erratic detritus, both large and small, is rounded, and has undergone great attrition; and he quotes a number of cases in which such boulders and gravel, derived from the central ridges of Mont Blanc, have been transported across tracts now consisting of lofty ridges of limestone with very deep intervening valleys; and, therefore, he infers that the whole configuration of these lands has been since much changed, including the final excavations of the valleys and the translation of enormous masses of broken materials into the low countries of France. In conclusion it is suggested that the dispersion of the far-travelled Alpine blocks is a very ancient phenomenon in reference to the historic era, and must have been coeval with the spread of the northern or Scandinavian erratics, which it has been demonstrated was accomplished chiefly by floating ice, at a time when large portions of the Continent and of the British Isles were under the sea. Viewing it, therefore, as a subaqueous phenomenon, Sir Roderick is of opinion that the translation of the Alpine blocks to the Jura falls strictly within the dominion of the geologist, who treats of bygone events, and can no longer be reasoned upon by the meteorologist, who invokes a long series of years of sunless and moist summers to account for the production of gigantic glaciers upon land. This last hypothesis is at variance even with the physical phenomenon in and around the Alps, whilst it is in entire antagonism to the much grander and clearly established distribution of erratics of the north during the glacial period. The effect in each case is commensurate with the cause. The Scandinavian chain, from whence the blocks of central Europe radiated, is of many times larger area than the Alps, and hence its blocks have spread over a much greater space. All the chief difficulties of the problem vanish when it is demonstrated that enormous changes of the level of the land in relation to the waters have taken place since the distribution of large erratics; the great northern glacial continent having subsided, and the bottom of the sea farther south having been elevated into dry land, whilst the Alps and Jura, formerly at lower levels, have been considerably and irregularly raised.

* Mr. Charles Darwin, in a recent letter to the author, says:—"I feel most entirely convinced that floating ice and glaciers produce effects so similar that at present there is, in many cases, no means of distinguishing which formerly was the agent in scoring and polishing rocks. This difficulty of distinguishing the two actions struck me much in the lower parts of the Welsh valleys."

PARIS ACADEMY OF SCIENCES.

M. Despretz gave an account of a series of experiments lately made by him with the view of testing those made by M. du Bois Remond on the deflection of the needle by electric currents, developed by muscular action. M. Despretz employed for this purpose a galvanometer, made by M. Richinkorff, the diameter of which was one tenth of a decimetre (0.393 inch). The sensitiveness of this apparatus is indicated by the following trials to which it was subjected:—

A copper wire, three fourths of a millimetre (0.0393 inch) in diameter, and dipping two centimetres, indicated a deflection of two centimetres in distilled water, 25 centimetres in Seine water, and 68 centimetres in a solution containing 4 to 5-100ths of common salt. Thin plates of gold, with about one centimetre square of surface, gave, under the same circumstances, 11, 24, and 85. The gold employed was perfectly pure, and was recently refined at the Mint at Paris. The needle passed from 50° to zero in about half a minute.

From the first announcement of the results obtained by M. du Bois Remond, M. Despretz operated by holding two cylindrical conductors in his hands. He observed the deviation, and when the needle was at zero, or had become stationary, he endeavoured forcibly to contract one of his arms. He noticed the deviation, and then, when the needle became stationary, he forcibly contracted the other arm, and observed the deviation on the galvonometer. His first experiments were made with ordinary copper conductors, but, in order to avoid all objection which might be urged on account of the ready oxidation of that metal, he coated the copper conductors with gold leaf; other conductors he coated with silver, platinum, and gold. Three persons were engaged in the experiments. M. Despretz says:—

"When we had not occasion to use the galvanometers we were tempted to believe that silver, and especially gold and platinum, retaining their polish and brilliancy when exposed to the air, would answer for these kinds of experiments, on account of their inalterability. Such, however, is not the case; silver, gold, and platinum give currents almost as powerful as copper. When the platinized conductor is in the hand, and the needle becomes stationary, it is only necessary to turn it with the finger more or less, to alter the position of the needle several degrees. In these experiments the needle passed 50, 75, and even 90 degrees. When one of the conductors was strongly squeezed the needle turned in one direction; and when the other conductor was squeezed the needle deviated either in the same or in a contrary direction."

When M. Despretz was informed of the detail of the process followed by M. du Bois Remond he made some experiments exactly similar, and other with certain variations. The following is his own account of this part of his observations:—

"I wished first of all to ascertain if it was not an effect of the thermo-electricity. To ascertain this I heated one of the soldered joints to the melting point of wax, the communication being established between the two metallic plates. I also raised the temperature of one of the two solutions of common salt, by plunging in them glass tubes filled with boiling water, the communication being always kept up by the hands. In neither the one case nor the other could I observe the slightest deviation.

"In order to avoid the deep immersion of the metallic plates, on account of the introduction of the fingers, I covered a part of the plates with black wax, so that the naked surface was always in contact with the solution. In the experiments made according to the plan of M. du Bois Remond, the alternate contraction of each arm gave sometimes deviations in one direction, and at other times deviations in a contrary direction.

"In other experiments I contracted each arm in succession, and at each contraction connected the vessel by means of the fingers. In other experiments large basins were employed, in order to give more liberty to the movement of the hands. The results of these two series of experiments were sometimes favourable and sometimes opposed to the statement of M. du Bois Remond. The necessity of repeated experiments was thus clearly shown. It often happened that the results of two or three experiments accorded with the results stated by M. du Bois Remond; and then, if the experiments were continued further, the results were found to be opposed. A singular fact was noticed in these researches; it was this—that the fingers act much the same as metallic conductors; they lose a part of their efficiency by repeated immersions.

"I wished to reduce the experiment to a still greater degree of simplicity. For this purpose I substituted a frog for the galvanometer. Several persons, either alone or together, having forcibly contracted one of their arms, endeavoured, without success, to excite convulsions in connecting the two arms by means of the animal; nevertheless, with the assistance of a very fine thread, placed in contact with a zinc plate, without the aid of any liquid, marked convulsions were produced. I also endeavoured, with success, to deflect a magnetic needle. Lastly, I attached a gilded conductor to the back of each hand by means of silk thread; although each arm was contracted in succession, no deviation was produced. These three experiments appear to me to have been performed under better conditions than those of M. du Bois Remond. The results are deprived of the somewhat obscure intervention of metallic plates dipping into saline solutions; unfortunately, they gave only negative results."

In conclusion, then, although it has not been completely demonstrated, yet we think that the results of our experiments go to prove that the contraction of the muscles of the arm do not produce an electric current. There may be in this phenomenon, as in a thousand others, some

electricity decomposed, but immediately recomposed, since we are unable to render it apparent. As long as chemistry has not discovered a metal or metallic alloy which does not disengage electricity by contact with liquid conductors, so long shall we be exposed to many illusions and many errors in our researches on the electric currents of animals and vegetables. The galvanometer is a very valuable instrument, but it requires great skill and great care on the part of the operator; if it be not very sensitive, it indicates only powerful phenomena; if a great degree of sensitiveness be given to it, it is acted upon by the slightest disturbing causes. It is not impossible but that a great number of the experiments on animal and vegetable currents give illusive results, and that the effects which are attributed to the animal and vegetable currents are only the action of liquid substances on the gold or platina plates of the electroscopes, or other different liquids. If the two gold plates of an electroscope be plunged in a certain direction into a potato, whether in the act of germination or not, or in the side of a cabbage, or the skin of an ox,—if two parts somewhat moist be touched by the same plates, currents of electricity are produced. If one or other of these plates be successively drawn out, and replaced, after having been washed and wiped, the current is destroyed. If more or less of the plates be immersed, the same results are obtained. It is possible that the convulsions experienced by the frog by the contact of the crural nerves and the muscles of the leg arise only from the varied nature of the liquids which moisten these parts. It is possible that the permanency of the current of the frog may be due to a different alterability of the extremities of the animal by the various solutions employed in the experiments.

M. Becquerel also communicated to the academy the results of his researches on the same subject; stating that he, like M. Despretz, had failed in his endeavours to verify the statement of M. du Bois Reimond, that the contraction of the muscles of the arm produced a current of electricity.

ON THE PRODUCTS OF THE METAMORPHOSIS OF LACTIC ACID BY NASCENT CHLORINE.

By Dr. STÆDELER.

When lactic acid or a lactate is distilled with chloride of sodium, manganese, and sulphuric acid, a product is obtained from which heavy oily drops with the odour of the superchloride of formyle separate upon the addition of potash.

When there is not sufficient chloride present, aldehyde is principally formed; potash then merely produces a turbidness in the distillate, and after some time a brown resinous substance (aldehydic resin) separates. This is the case, for instance, when 1 part protolactate of iron, 4 parts of manganese and salt, and 4 parts of sulphuric acid diluted with twice its weight of water, are submitted to distillation. If this relation is varied, so that 10 parts of manganese and salt, 10 parts of sulphuric acid, and 12 to 14 parts of water are employed for every 1 part of the lactate of the protoxide of iron, the action of the chlorine proceeds very regularly; and only in the first portions of the distillate can any aldehyde be detected by the odour and by the reaction with potash. If that which passes over subsequently is collected separately, and rectified over chloride of calcium, the product may be mixed without any evolution of heat or coloration with concentrated sulphuric acid; and when set aside a colourless liquid, resembling chloral, separates from it. This, however, is not pure chloral; for, on attempting to separate it by distillation from sulphuric acid, the greater portion is decomposed with evolution of hydrochloric acid, and the sulphuric acid becomes coloured black; that which passes over, however, is principally chloral. With a little water it is converted into crystalline hydrate of chloral. —Liebig's *Annalen*.

CHEMICAL TABLES, ARRANGED FOR THE CHEMICAL TIMES,

By GEORGE CALEY, Esquire, Mortimer-terrace, Notting-hill, Kensington.

[*Continued from page* 415.]

Table IV.

TABLE OF THE MORE IMPORTANT BINARY COMPOUNDS OF THE METALS AND METALLOIDS, WITH THEIR NAMES, FORMULÆ, ATOMIC WEIGHTS ON THE OXYGEN AND HYDROGEN SCALES, AND THEIR PER-CENTAGE COMPOSITION.

Names of Compounds.	Formulæ.	Atomic Weights on the Hydrogen and Oxygen Scales. H=1.	O=100.	Per-centage Composition.
Aluminium	Al	13.72	171.17	
Alumina (oxide)	$Al^2 O^3$	51 47	642.33=Al	53.30—O 46.70
Sesquichloride	$Al^2 Cl^3$	133.85	1670.29=Al	20.50—Cl 79 50
Sesquiodide	$Al^2 I^3$	407.13	5080.83=Al	6.74—I 93.26
Sesquifluoride	$Al^2 F^3$	83.64	1043.73=Al	32.80—F 67.20
Ammonium (hypothetical compound radical)	NH^4	18.19	226.95=N	78.00—H 22.00
Oxide of ammonium	$NH^4 O$ = NH^3,HO	26.20	326.95=NH^4	69.42—O 30.58
Bromide	$NH^4 Br$	96.58	1205.26=NH^4	18.83 - Br 81.17
Chloride	$NH^4 Cl$	53.66	669.61=NH^4	33.89—Cl 66.11
Fluoride	$NH^4 F$	36.92	460.70=NH^4	49.26—F 50.74
Sulphuret	$NH^4 S$	34.31	428.12=NH^4	53.01—S 46.99
Antimony	Sb	64.62	806.45	
Sesquioxide	$Sb^2 O^3$	153.28	1912.90=Sb	84.32—O 15.68
Antimonious acid	$Sb^2 O^4$	161.30	2012.90=Sb	80.13—O 19.87
Antimonic acid	$Sb^2 O^5$	169.31	2112.90=Sb	76.34—O 23.66
Sesquichloride	$Sb^2 Cl^3$	235.65	2940.86=Sb	54.84—Cl 45.16
Perchloride	$Sb^2 Cl^5$	306.59	3826.16=Sb	42.16—Cl 57.84
Bichloride	$Sb^2 Cl^4$	271.12	3383.51=Sb	47.67—Cl 52 33
Sesquibromide	$Sb^2 Br^3$	364.42	4547.82=Sb	35.47—Br 64.53
Perbromide	$Sb^2 Br^5$	521.21	6504.43=Sb	24.80—Br 78.20
Perfluoride	$Sb^2 F^5$	222.92	2781.91=Sb	57.98—F 42.02
Sesquisulphuret	$Sb^2 S^3$	177.60	2216.40=Sb	72.77—S 27.23
Bisulphuret (sulphantimonious acid)	$Sb^2 S^4$	193.73	2417.56=Sb	66.72—S 33.28
Persulphuret (sulphantimonic acid)	$Sb^2 S^5$	209.84	2618.73=Sb	61.59—S 38.41
Arsenic	As	37.67	470.04	
Arsenious acid	$As^2 O^3$	99.37	1240.08=As	75.81—O 24.19
Arsenic acid	$As^2 O^5$	115.39	1440.08=As	65.28—O 34.72
Sesquibromide	$As^2 Br^3$	310.41	3875.00=As	24.26—Br 75.74
Sesquichloride	$As^2 Cl^3$	181.74	2268.04=As	41.45—Cl 58.55
Sesquioide	$As^2 I^3$	455.03	5678.58=As	16 55—I 83.45
Arsenuretted hydrogen gas	$H^3 As^2$	78.33	977.52=H	3.88—As 96.12
Sesquifluoride	$As^2 F_3$	131.53	1641.49=As	57.27—F 42.73
Sesquisulphuret (sulpharsenious acid)	$As^2 S^3$	123.69	1543.53=As	60.90—S 39.10
Persulphuret (sulpharsenic acid)	$As^2 S^5$	155.93	1945.91=As	48.31—S 51.69
Barium*	Ba	68.66	856.88	
Protoxide	BaO	76.68	956.88=Ba	89.55—O 10.45
Peroxide	BaO^2	84.69	1056 88=Ba	81.08—O 18.92
Bromide	BaBr	147.06	1835.19=Ba	46.69—Br 53.31
Chloride	BaCl	104.13	1299 53=Ba	65.94—Cl 34.06
Fluoride	BaF	87.40	1090.68=Ba	78.56—F 21.44
Iodide	BaI	195.23	2436.38=Ba	35.17—I 64.83
Sulphuret	BaS	84.78	1058.05=Ba	80.99—S 19.01
Bismuth	Bi	71.07	886.92	
Protoxide	BiO	79.08	986.92=Bi	89.87—O 10.13
Peroxide	$Bi^2 O^3$	166.18	2073.84=Bi	85.53—O 14.47
Bromide	Bi Br	149.46	1865.22=Bi	47.55—Br 52.45
Chloride	Bi Cl	106.54	1329.57=Bi	66.71—Cl 33.29
Sulphuret	BiS	87.19	1088.08=Bi	81.51—S 18.47
Cadmium	Cd	55.83	696.77	
Oxide	CdO	63.85	796.77=Cd	87.45—O 12.55
Bromide	Cd Br	134.23	1675.07=Cd	41 60—Br 58.40
Chloride	Cd Cl	91.30	1139 42=Cd	61.15—Cl 38.85
Iodide	CdI	182.40	2276.27=Cd	30.61—I 69.39
Sulphuret	CdS	71.95	973.93=Cd	76.60—S 22.40
Calcium	Ca	20.52	256.02	
Protoxide (lime)	CaO	28.53	356.02=Ca	71.91—O 28.09
Peroxide	CaO	36.54	456.02=Ca	56.14—O 43.86
Bromide	Ca Br	98.91	1234.33=Ca	20.74—Br 79.26
Chloride	Ca Cl	55.98	698.67=Ca	36.64—Cl 63.36
Fluoride	CaF	39.29	489.82=Ca	52.27—F 47.73
Iodide	CaI	147.08	1835 52=Ca	13.95—I 86.05
Sulphuret	CaS	36 64	457.18=Ca	56.00—S 44.00

* M. Marignac recently undertook some experiments to ascertain the true atomic weight of barium, which he fixes at 68.54 H=1, or 856.77 O=100. This is almost exactly the mean of the numbers found by Berzelius and Pelouze, and which are given above.—(See *Chem. Times*, p. 3, v. 5.)

TABLE IV.—(*Continued.*)

Names of Compounds.	Formulæ.	Atomic Weights on the Hydrogen and Oxygen Scales. H=1.	O=100.	Per-centage Composition.
Bisulphuret	CaS^2	52.75	658.35=Ca	38.89—S 61.11
Persulphuret	CaS^5	101.11	1261.84=Ca	20.29—S 79.71
CHROMIUM	Cr	28.19	351.82	
Sesquioxide	Cr^2O^3	80.42	1003.63=Cr	70.11—O 29.89
Chromic acid	CrO^3	52.23	651.81=Cr	53.97—O 46.03
Perchromic acid	C^2O^7?			
Sesquichloride	Cr^2Cl^3	162.79	2031.51=Cr	34.63—Cl 65.37
Fluoride	Cr^2F^3? or Cl^2F^5?			
COBALT	Co	29.57	368.99	
Protoxide	CoO	37.58	468.99=Co	78.68—O 21.32
Peroxide	Co^2O^3	83.17	1037.98=Co	71.10—O 28.90
Chloride	Co Cl	65.04	811.64=Co	45.46—Cl 54.54
Protosulphuret	CoS	45.69	570.16=Co	64.72—S 35.28
Sesquisulphuret	Co^2S^3	107.49	1341.48=Co	55.01—S 44.99
COPPER	Cu	31.71	395.70	
Dinoxide (red oxide)	Cu^2O	71.43	891.30=Cu	88.78—O 11.22
Oxide (black oxide)	CuO	39.72	495.70=Cu	79.83—O 20.17
Peroxide	CuO^2	47.73	595.70=Cu	66.43—O 33.57
Dibromide	Cu^2Br	141.81	1769.70=Cu	44.72—Br 55.28
Bromide	Cu Br	110.10	1374.00=Cu	28.80—Br 71.20
Dichloride	Cu^2Cl	98.88	1234.04=Cu	64.13—Cl 35.87
Chloride	Cu Cl	67.18	838.35=Cu	47.20—Cl 52.80
Difluoride	Cu^2F	82.15	1025.19=Cu	77.19—F 22.81
Fluoride	CuF	50.47	629 50=Cu	62.86—F 37.14
Diniodide	Cu^2I	189.98	2370.89=Cu	33.38—I 66.62
Iodide	CuI	158.27	1975.19=Cu	20.03—I 79.97
Disulphuret	Cu^2S	79.54	992 56=Cu	79.73—S 20.27
Sulphuret	CuS	47.83	596.86=Cu	66.30—S 33.70
Triphosphuret	Cu^3P	110.84	1383.25=Cu	85.82—P 14.18

[*To be continued.*]

ON THE ACTION OF NITRIC ACID UPON SEBACIC ACID.

By ADOLPH SCHLIEPER.

It is generally asserted that sebacic acid is not altered by treatment with nitric acid; but the similarity of many of its physical properties with benzoic acid authorized the conjecture, that, like the latter, it might be converted into nitro-sebacic acid, $C^{10}H^7O^3NO^4$. In all cases it was interesting to know if the action of nitric acid on this constant product of decomposition of oleic acid at high temperatures did not cause the formation of one or more of those acids which Laurent produced by direct action of this agent upon oleic acid.

The sebacic acid employed in this research was obtained by dry distillation of the crude commercial oleic acid. The distillate was boiled with water several times, the watery extracts saturated with carbonate of soda and evaporated to dryness, to remove the caprylate and caprinate of soda; the dry saline mass was then exhausted with hot absolute alcohol, which left the sebacate of soda undissolved. The latter was then dissolved in water, and the sebacic acid precipitated by addition of muriatic acid; after being purified by repeated crystallizations from water it presented itself as a loose, very light, white mass, consisting of small shining scales.

To ascertain whether any formation of nitro-sebacic acid takes place, 1 part of sebacic acid was heated with 20 to 30 parts crude nitric acid, spec. grav. 1.4, in a spacious matras; no solution is effected in the cold, but it takes place perfectly a little below the boiling point; at the same time the orange-coloured vapours of hyponitrous acid and the like colour which the liquid assumes indicate a decomposition of the sebacic acid. The nitric solution was then kept at a continual slow boiling on a sand-bath, in such a manner that the evaporating nitric acid condensed for the greater part in the long neck of the matras, and flowed back. After two to three hours' boiling a small part of the solution was poured out to see if the formation of nitro-sebacic acid had taken place, though the continual, but very slow, development of red vapours indicated clearly that the decomposition was not yet finished.

The hot nitric solution, mixed with eight to ten times its volume of cold water, separated a great quantity of probably unaltered sebacic acid, which, having been washed and dried, showed all the physical properties of that substance. I prepared and analyzed the silver salt of the acid so obtained, and thus proved that it was only unaltered sebacic acid. 0.312 grm. of the silver salt gave 0.161 grm. silver, which corresponds to an amount of oxide of silver of 55.41 per cent. Sebacate of silver contains 55.76 per cent. oxide of silver.

I may here mention an easy method of obtaining perfectly snow-white sebacic acid, this material having generally a yellowish tint. It is sufficient just to boil 1 part of impure sebacic acid with 5 to 6 parts of nitric acid, spec. grav. 1.35, and then mix the solution with a great quantity of boiling water; on cooling, the sebacic acid crystallizes perfectly pure.

The rest of the solution of sebacic acid in nitric acid was kept continually boiling till the entire cessation of the formation of nitric oxide, constantly renewing the evaporating nitric acid. The oxidation takes place very slowly; it required eight days for about 200 grs. of sebacic acid. After the solution had changed its orange to a nearly white colour, and the development of nitric oxide had ceased, the contents of the matras were poured into a flat basin, diluted with an equal volume of water, and the nitric acid slowly driven off on the water-bath, using the precaution of adding from time to time a small quantity of water. The white residue was then dissolved in water, filtered, and evaporated to a syrup on the water-bath, then allowed to crystallize over sulphuric acid. Regular crystals could not be obtained, perhaps because the quantity of the solution was not sufficient; but the whole solution solidified very soon, and became a white crystalline mass, somewhat adhesive, appearing like pure grape sugar crystallized in a similar way. This substance, in a perfectly pure state, is a strong acid, and the only product which results from the action of nitric acid on sebacic acid. It is, as will presently be proved, identical in composition and properties with pyrotartaric acid, as far as a comparison was possible with the knowledge we possess of the latter.

For analysis, the acid was dried over sulphuric acid, and afterwards melted, but without sustaining any loss in its previous weight. It was burnt with chromate of lead, and gave the following results:—

Carbon	45.27	45.42	5 = 30		45.45
Hydrogen	6.09	6.09	4	4	6.06
Oxygen	48.64	48.49	4	32	48.49

Hence 1 equiv. of sebacic acid assimilates 5 equivs. of oxygen on treatment with nitric acid, and is resolved into 2 equivs. of the hydrate of pyrotartaric acid:—

1 eq. of sebacic acid = $C^{10}H^8O^3$
5 equivs. of oxygen = O^5

2 eq. of the hydrate of pyrotartaric acid = $C^{10}H^8O^8 = 2(C^5H^3O^3, HO)$

This acid thus differs from lipic acid, which it resembles in many properties, only by 1 equiv. less of oxygen. The acid in question has the following qualities, which coincide very nearly with those of pyrotartaric acid, as stated by Pelouze. The very slight deviations in regard to the crystallization of the acids it was impossible for me to reconcile, on account of the small quantity of the new acid at my command. The acid forms a perfectly white, slightly crystalline mass, a little adhesive, and permanent in the air; heated in the water-bath, it became semifluid; but heated a few degrees above 212° F. it melted into a clear fluid, solidifying when cooled into a crystalline mass. Heated very cautiously on platinum, it volatilizes entirely, evolving a white suffocating vapour. Heated between two watch glasses, it sublimes, leaving a carbonaceous residue, in very shining prismatic needles, which show all the reactions of the unsublimed acid. The acid is inodorous, and has a very acid taste, similar to that peculiar to succinic acid. It is easily soluble in water, alcohol, and ether, also in concentrated sulphuric acid, without being decomposed. Heated with alcohol and sulphuric acid, the ether of this acid is readily formed, which is distinguished by a peculiar aromatic odour. The watery solution expels carbonic acid with effervescence, and forms gummy salts with potash, soda, and ammonia when evaporated briskly, but whose concentrated solutions, allowed to evaporate over sulphuric acid, dry to crystalline masses. The ammonia salt loses ammonia on evaporation, and becomes acid. The alkaline salts are soluble in alcohol; furnish no precipitates with baryta and lime salts; with chloride of iron a flocculent brownish-red precipitate, soluble in a pretty large quantity of boiling water; and with copper salts a light green precipitate. With acetate of lead no precipitate results; but after two or three hours the mixture of the solutions, not too much diluted, deposits a white lead salt in granules, principally adhering to the sides of the vessels; once separated they are difficultly soluble in water. If an addition of alcohol is made to the mixed solutions of acetate of lead and the ammonia salt of the acid a thick white precipitate is produced directly, melting to small drops when heated, and evidently the same precipitate which deposits after a longer standing of the solutions without the addition of alcohol. The ammonia salt gives with basic acetate of lead a thick curdy precipitate, cohering after some hours, easily soluble both in acids and in an excess of basic acetate of lead. Nitrate of silver is precipitated by the ammonia salt in white flakes, very like freshly-precipitated alumina.

All these properties agree so perfectly with those of pyrotartaric acid as described by Pelouze that, considering the similarity of the composition of both acids, I do not hesitate in the least to proclaim the identity of pyrotartaric acid with the acid obtained by the oxidation of sebacic acid with nitric acid.

From the statements of Weniselos my own differ only in regard to the ammonia salt, which that chemist states he obtained in fine crystals; and in regard to the neutral lead salt, which ought to deposit itself after a certain time in fine needles, whereas Pelouze, as well as myself, obtained only granulated precipitates under the same conditions.

For further analysis I selected the silver salt, which was prepared by precipitating the nitrate of silver with the ammonia salt of the acid; but I am sorry to say that I did not succeed in obtaining it of a constant composition, which is very remarkable in a silver salt. I procured from salts of two different preparations 2 to 3 per cent. of oxide of silver less than the formula AgO, PT required; though the acid combined with it, calculated by itself, after deduction of the mean amount of oxide of silver, corresponded exactly to the formula of the anhydrous acid.

The silver salt is very sensible to light; dries slowly, and forms semitransparent hard pieces, very like the dried hydrate of alumina, which become brownish-white when powdered. The analysis gave the following results:—

	First preparation.	Second preparation.	Calculated according to $C^5 H^3 O^3$ AgO.
Silver	64.11	64.01	64.88	67.05
Carbon	18.88	..	18.34	17.35
Hydrogen.	2.06	..	1.97	1.73
Oxygen ..	..	..	..	13.87

The lead precipitate which is produced by basic acetate of lead in the ammonia salt furnished on analysis 73.21, 72.70, and 73.0 per cent. oxide of lead, which amount corresponds exactly with the formula 2(PbO, $C^5 H^3 O^3$)+ PbO, HO The identity of this acid with pyrotartaric acid can hardly be doubted; however, a further comparison will only be possible when the latter has been submitted to a more accurate examination.—Silliman's *Journal*, May, 1849.

ON THE CHLORINATED PRODUCTS OF DECOMPOSITION OF QUINIC ACID.

By Dr. G. STÆDELER.

When quinic acid is distilled with a mixture for evolving chlorine a violent disengagement of carbonic acid results; whilst an acid liquid, and a yellow crystalline sublimate which condenses in the tube through which the vapours are conducted, are obtained.

The liquid contains formic acid, and the same oily substance in solution which is produced under similar circumstances from starch, and which was formerly described by the author by the temporary name *a*-oil. It is a very general product of the decomposition of organic substances by chlorine; and the author hopes soon to be able to give further details respecting its composition and properties.

The crystalline sublimate is a mixture of four substances, which, as regards their composition, are members of the quinone series. They may be viewed as quinones, in which one, two, three, or the whole of the equivalents of hydrogen have separated, and are replaced by a corresponding number of equivalents of chlorine. All the members of this group possess the peculiarity of quinone of combining with hydrogen, and forming with it combinations analogous to the hydroquinones. The last member is already known; it is the chloranile discovered by Erdmann; to the others the author has assigned the names of chloroquinone, bichloroquinone, and trichloroquinone.

To separate these substances the mixture is first exhausted with cold alcohol, which dissolves chloroquinone and trichloroquinone, whilst bichloroquinone and chloranile, which are only soluble in boiling alcohol, are left behind. Chloroquinone and trichloroquinone are precipitated from the alcoholic solution by water, then dissolved in a small quantity of boiling alcohol, and separated from each other by crystallization. To separate the bichloroquinone from the chloranile, the two are dissolved in boiling alcohol, when bichloroquinone separates on cooling in brilliant lemon-coloured crystals, and the chloranile in very delicate iridescent laminæ, which can easily be poured off the heavy crystals of bichloroquinone.

I. *Chloroquinone*, $C^{12} H^3 Cl O^4$.—It has hitherto been found impossible to separate the chloroquinone perfectly from trichloroquinone: a mixture of laminæ and needles was always obtained, which consisted, according to the analyses, of nearly equivalent proportions of the two substances (= $C^{12} H^3 ClO^4 + C^{14} H Cl^3 O^4$). It might also be concluded from the analyses that it was a combination of equivalents of chloroquinone and trichloroquinone with a slight excess of the latter; but, so far as the eye was able to decide, the quantity of laminæ was far greater than would correspond to such an inconsiderable impurity; and, moreover, the compound, freed as much as possible from trichloroquinone, agrees so closely in its properties with quinone, that we are compelled to adopt the view that it is a quinone in which 1 equiv. hydrogen is replaced by 1 equiv. chlorine. It crystallizes in very delicate, sometimes in long yellow, needles, which fuse even at 212° to a dark yellow oily liquid; and which communicate to the skin, and to organic substances in general, a purple colour, like the salts of gold. It has a peculiar aromatic odour and an acrid burning taste; it is readily soluble in ether, alcohol, and concentrated acetic acid; less so in boiling water, and almost entirely insoluble in cold water. With cold concentrated sulphuric acid it forms a reddish-yellow solution, which, in a few minutes, solidifies to a paste of very delicate white prisms. When sulphurous acid is poured over it, it assimilates hydrogen, and is converted into brown or colourless chlorohydroquinone according to the amount of acid; it, however, could not be obtained pure any more than the chloroquinone, and, consequently, was not analyzed.

II. *Bichloroquinone*, $C^{12} H^2 Cl^2 O^4$, separates from the boiling saturated alcoholic solution in minute, shining, bright lemon-coloured crystals, and from a mixture of alcohol and ether in dark yellow prisms several lines in length. They have a faint aromatic odour, and scarcely any taste. They melt at 302° to a reddish liquid, which on solidification reacquires its former colour. Bichloroquinone is insoluble in water and cold alcohol, but readily soluble in ether, boiling alcohol, and boiling acetic acid. Dilute solution of caustic potash dissolves it with a reddish-brown colour, with the production of a new acid, which closely resembles chloranilic acid. It is not decomposed by concentrated sulphuric, nitric, or muriatic acids; sulphurous acid converts it into bichlorohydroquinone.

Colourless Bichlorohydroquinone, $C^{12} H^4 Cl^2 O^4$, is obtained when bichloroquinone is boiled with a sufficient quantity of sulphurous acid; as the colourless solution cools it separates in long flat needles, or in short thick prisms, which are but sparingly soluble in cold, but readily in boiling, water, as also in alcohol, ether, and hot acetic acid. It likewise dissolves without decomposition in hot concentrated sulphuric and muriatic acids. Nitric acid converts it into bichloroquinone, whilst perchloride of iron or nitrate of silver change it into

Violet Bichlorohydroquinone.—The same substance is produced when an aqueous solution of colourless bichlorohydroquinone is boiled with bichloroquinone. It separates from the dark brown solution in small, dark, violet, or long, flat, blackish-green needles, of equal beauty with the green hydroquinone. It is almost insoluble in cold, but soluble in boiling, water and in hot acetic acid, on the cooling of which it again separates unaltered. Its composition corresponds to the formula $C^{12} H^3 Cl^2 O^4 + 2HO$; it consequently contains just as much hydrogen as the very similar green hydroquinone. It is unaltered in the air; but dried over sulphuric acid, or heated to about 158°, it loses its two atoms of water, and passes into yellow bichlorohydroquinone. The same compound is formed on adding alcohol, ether, or concentrated sulphuric acid to the violet bichlorohydroquinone. Concentrated nitric acid converts it into bichloroquinone.

The Yellow Bichlorohydroquinone, $C^{12} H^3 Cl^2 O^4$, melts at about 228° to a red liquid, and is decomposed into bichloroquinone and white bichlorohydroquinone, which are deposited in the cold portion of the tube in isolated crystals. It has a burning aromatic taste, and a faint odour resembling bichloroquinone. It dissolves in alcohol, ether, boiling water, hot acetic acid, and also in concentrated sulphuric acid without decomposition. On the cooling of the aqueous, or on slow evaporation of the ethereal, solution, there is always a partial conversion of the yellow into the violet compound.

III. *Trichloroquinone*, $C^{12} HCl^3 O^4$, forms large golden laminæ, which melt at 320°, and sublime even at 266° pretty rapidly in delicate laminæ resembling chloranile. It has no smell, and does not colour the skin when perfectly free from chloroquinone. It is insoluble in cold water, sparingly soluble in cold alcohol and acetic acid, but readily soluble in ether, boiling alcohol, and boiling acetic acid, even when they are diluted with an equal volume of water. It dissolves in concentrated sulphuric and nitric acids without decomposition; by the action of potash a salt of a new acid separates in long red needles, which dissolve in water with a wine-red colour; and on mixing the solution with muriatic acid the acid falls in red crystals. Concentrated ammonia appears to produce a compound analogous to chloranilammon.

When trichloroquinone is boiled with a sufficient quantity of sulphurous acid it dissolves; and on evaporating the colourless solution,

Colourless Trichlorohydroquinone, $C^{12} H^3 Cl^3 O^4$, separates in heavy oily drops, which solidify into crystalline masses on cooling. Once separated, the trichlorohydroquinone is very sparingly soluble in cold water; it melts in boiling water, and gradually dissolves. It is readily soluble in ether and in alcohol; and the solutions, which have an acid reaction, furnish a white precipitate with neutral acetate of lead. Concentrated sulphuric acid dissolves it without decomposition; concentrated nitric acid converts it into yellow trichloroquinone. On mixing the solution with nitrate of silver or perchloride of iron a compound separates in minute yellow laminæ, which appear under the microscope to be very oblique four-sided prisms, and which seem to be a combination of trichloroquinone with 1 equiv. hydrogen, or

Yellow Trichlorohydroquinone.—This compound was discovered some time ago by Woskressensky, by passing chlorine over quinone, then subliming the chlorinated product in a current of the gas, and purifying it by recrystallization from alcohol. He, however, erroneously supposed that this substance was formed by the quinone exchanging three equivs. hydrogen for an equal number of chlorine, and called it chloroquinoyle. According to Woskressensky's view, therefore, chloroquinoyle, for which subsequently the name chloroquinone was substituted, would have the same composition as trichloroquinone; which, however, is not confirmed by his analyses nor by the properties of this substance, which are totally different from those of trichloroquinone. Woskressensky's chloroquinoyle, from its properties as well as from its composition, is a hydrogen compound of trichloroquinone, and its formula is $C^{12} H^2 Cl^3 O^4$.

IV. *Chloranile*, $C^{12} Cl^4 O^4$.—It has already been stated in what manner chloranile can be separated from the other solid products which are formed in the distillation of quinic acid with a mixture for generating chlorine. It is, however, always obtained only in small quantity. Erdmann first procured it by the action of chlorine upon an alcoholic solution of chlorisatine and bichlorisatine; and subsequently other processes for its preparation were described by Fritzsche and Hofmann. Its properties, and principally the products of its metamorphoses by

alkalis, have been minutely investigated by Erdmann. There remains its behaviour towards sulphurous acid, which distinctly proves chloranile to be a member of the quinone series.

Colourless Chlorohydroanile.—When chloranile is boiled with a solution of sulphurous acid and water, the yellow colour of the crystals is gradually changed into a dirty white; they are collected on a filter, washed with water, dried, and dissolved in a mixture of ether and weak spirit, when the colourless chlorohydroanile separates on the slow evaporation of the ether in groups of delicate nacreous laminæ. They are usually coloured somewhat brownish by some foreign substance, which is insoluble in boiling concentrated acetic acid, and can so be separated from the chlorohydroanile.

Its composition is expressed by the formula C^{12} H^2 Cl^4 O^4. Under exactly the same circumstances as quinone and chloroquinone, chloranile has likewise combined with two equivs. hydrogen; and we may consequently regard chloranile as a quinone in which the whole of the hydrogen has been replaced by chlorine.

Chlorohydroanile experiences no change at 302°, at 320° it is slightly browned, and between 415° and 420° it becomes dark brown and begins to sublime very rapidly; when heated more strongly it melts. It is obtained in long, flat, colourless needles by sublimation in a current of air; it has neither odour nor taste; is perfectly insoluble in water, but readily soluble in alcohol and ether; the solutions redden blue litmus-paper, and are precipitated by neutral acetate of lead. They are neither dissolved nor altered by concentrated sulphuric acid even on the application of heat; dilute solution of caustic potash dissolves it readily without any colour, and it is again separated by acids in a crystalline state. The hot saturated solution in potash deposits on cooling prismatic slightly coloured crystals, which, however, quickly turn red in the air. The solution in ammonia is yellow, and becomes, when exposed to the air, quickly green, and finally red, with separation of a chrome-green crystalline precipitate.

When treated with water which contains some perchloride of iron or nitric acid, the colourless chlorohydroanile is not altered in the cold, but at a gentle heat it turns yellow. Nitrate of silver acts in the same manner when an alcoholic solution of it is used; metallic silver is deposited as a mirror or in the form of a grey powder, and from the filtered boiling solution delicate yellow rhombic prisms separate on cooling, which appear to be a compound of chloranile with one equiv. hydrogen.

Hypochlorite of soda converts chlorohydroanile into a substance crystallizing in minute green prisms, which, however, was not further examined.—Liebig's *Annalen* and *Chem. Gazette.*

REVIEWS.

Defects in the Practice of Life Assurance, and Suggestions for their Remedy, with Observations on the Uses and Advantages of Life Assurance, and the Constitution of Offices. By Alexander Robertson, W.S., A.I.A. Published by Orr and Co.

This pamphlet is written avowedly with the view of recommending to public notice and favour a new life assurance company, founded on the novel principle of the absolute indisputability of the policies granted by it. The author of the pamphlet is the manager of this new company. This circumstance, however, detracts nowise from the value and solidity of the facts adduced by him, nor from the clearness and conclusiveness of his exposition and reasonings.

The principal object which Mr. Robertson has in view is to show that none of the life assurance companies, with the single exception of the Indisputable,* afford to the insured that perfect safety and freedom from all risk and apprehension which the term "assurance" implies; and he rightly imputes the slow and tardy progress of life assurance to the vicious principle of the legal disputability of the claims of policy holders, under pretext of "misrepresentation, concealment, or fraud." The following careful and minute investigation of the state of the law respecting contracts of life assurance cannot but prove of the deepest interest to all those who may feel disposed to resort to life policies as a provision for their family, or as security in pecuniary transactions:—

"The progress of life assurance has unfortunately been much retarded by disputes and lawsuits. Vexatious delays in the settlement of claims, extorted compromises, and protracted litigations, have had the effect of deterring many persons from resorting to life policies as provisions for families, or as securities in pecuniary transactions; and it is the object of the following observations to point out the risks to which the assured are exposed by the present method of conducting life assurance business, and that adequate and complete remedy which has been adopted and carried out by one life company. And for that purpose it is necessary to consider the terms and nature of the contract or policy between the assuring parties and the assured, as heretofore prepared and acted upon.

"Suppose the common case of a person, in the enjoyment of good health, desirous of procuring a policy of assurance upon his life for the benefit of his representatives at his death, or which he may employ during his life, as a document of security. He applies at the office, and fills up and signs the usual form of proposal for an assurance, containing generally a dozen or more questions, all of which he answers conscientiously, and as correctly as he can. He refers the company, for further information, or rather it may be said for confirmation of his own statements, to his doctor, and to his friend. To the doctor and the friend the company despatch other sets of questions, in different forms, generally more precise and searching than those submitted to the applicant himself. On these being received by the company, they are placed with the other papers connected with the case, but are not shown to the applicant; who is then examined by the medical adviser, and called upon to answer a different series of questions, relating chiefly to past events, and involving an opinion as to the state of his health at all periods since infancy, and his recollections and notions as to the nature of the different ailments which he or any of his family, or relatives, may have had.

"These several documents, viz., the proposal, the reports of the private medical adviser and friend, the statement made to the company's medical adviser, and his report, generally contain upwards of two hundred interrogatories and answers: many of them being repetitions of the same question; some of them relating to matters of fact of which the parties are cognizant; most of them to circumstances of which the persons applied to can have obtained a knowledge only by hearsay or collateral evidence; and many of them are mere matters of opinion, as to which different persons may have different notions; and to the questions relating to such matters it may be expected that the answers from the several persons, the proposer, the friend, the medical attendant, and the company's medical examiner, will not all be in unison. These papers being completed, and the premium paid, the policy is granted, and the assurance is supposed to be complete.

"There is a variety of expression to be found in the policies of different officers; and, while in some the whole import of the agreement between the assuring and assured may be gathered from the policy itself, it is the more common practice to make reference in the policy to the original proposal and other documents. There is, however, little or no difference, as to the legal construction to be put upon policies, as prepared by different offices.

"By the policy the assured undertakes to pay the premium regularly, and the company to pay the stipulated sum three months after the death of the assured; provided that 'every statement, declaration, and all testimonials and documents addressed to, or deposited with, the company in relation to the assurance, shall be found to be in all respects true.' It is further declared that these statements shall be held as warranted, and taken as the basis of the contract, and that the policy shall be void if any 'important information' has been omitted.

"The effect of these clauses, and the important consequences resulting from them, have been determined by decisions of the courts of law; and it is now settled, as we shall show by references to decided cases, institutional writers, and authors of repute, that if in the statements referred to, and which are declared to be the basis of the contract and to form matters of warranty, any fact, whether material or immaterial, has been erroneously stated, whether intentionally or not, or if any information considered important has been omitted to be communicated, although the party applied to for information did not consider the omitted fact to be of the slightest importance, the policy is void, and all premiums paid become forfeited to the company. We shall find that it is not enough that the written proposal and declaration made by the assured are unobjectionable. The friend's report and that of the medical referee, and all statements made by the person whose life is the subject of assurance, are regarded in the eye of the law as statements of the assured party, although he neither wrote them nor had an opportunity of seeing them. The policy is so prepared that the assured enters into a positive engagement that all these statements are in point of fact strictly and literally true, whether he was aware of them or not. Such an engagement being in legal language a warranty, and the effect of a warranty being to render the facts alleged in it a condition precedent of the assurer's responsibility, it follows that the obligation undertaken by the office is only effectual 'if,' and 'in the event that,' each of the many statements, whether material or of no importance, is literally as it has been represented.

"Many of the questions contained in the several documents issued by the company are trifling and seemingly unimportant; and as Mr. Dowdeswell remarks, 'since it is competent for parties to make their contracts dependent upon any conditions which even caprice may suggest, whether the portion of a warranty eventually discovered to be incorrect or not complied with be material, or wholly immaterial, with respect to the nature of the risk, the result will be the same, and where the truth of the facts are positively alleged, and not limited to the knowledge of the assured, although a mistatement may have arisen from the most innocent mistake, or from false information afforded by others, or mere inadvertence, the assured will be in the same position as to legal remedies in the contract as if he made the most wilfully fraudulent averment.'

"Whenever a statement is embraced in a warranty, it must be proved to be strictly and literally true, whether material to the risk or not. Thus Lord Eldon, in moving the House of Peers, observes, 'it is a first principle in the law of insurance, on all occasions, that where a representation is material it must be complied with. If immaterial, that immateriality may be inquired into and shown; but that, if there is a warranty, it is part of the contract that the matter is such as it is represented to be, therefore the materiality or immateriality signifies nothing. The only question is as to the mere fact.'

"Mr. Sergeant Marshall, in treating of warranties, observes, 'A warranty being in the nature of a condition precedent, and therefore to be performed by the insured, before he can demand performance of the contract on the part of the insurer, it is quite immaterial for what purpose or with what view it is made, or whether the insured had any view at all in making it, but, being once inserted in the policy, it becomes a binding condition on the insured, and unless he

* The London Indisputable Life Policy Company, 31, Lombard-street.

can show that it has been strictly fulfilled he can derive no benefit from the policy. The very meaning of a warranty is to preclude all question, whether it has been substantially complied with or not. If it be affirmative it must be literally true, if promissory it must be strictly performed.

"'The breach of a warranty, therefore, consists either in the falsehood of an affirmative or the non-performance of an executory stipulation; in either case the contract is void *ab initio*, the warranty being a condition precedent. And whether the thing warranted was material or not—whether the breach of it proceeded from fraud, negligence, misinformation, or any other cause—the consequence is the same. The warranty makes the contract hypothetical; that is, it shall be binding if the warranty be complied with. With respect to the compliance with warranties there is no latitude, no equity; the only question is, has the thing warranted taken place or not? If not, the insurer is not answerable for any loss, even though it did not happen in consequence of the breach of the warranty.' So also, Mr. Ellis, in his work on the Law of Insurance, says, 'If there is a warranty, the person warranting undertakes that the matter is such as he represents it; and unless it be so, whether it arise from fraud, mistake, negligence of an agent, or otherwise, then the contract is not entered into; there is, in reality, no contract.'

"The obvious effect of the preceding doctrine of law, when applied to life policies, as these documents are now framed, is, that although the company have had the means of satisfying themselves, from medical examinations, reports, and other documents, and any other inquiry they may have chosen to make, that the life is insurable, and parties have for years regularly paid the premiums, the question whether there is an assurance or not still remains open as against the assured; whose policy may at any future time be questioned, upon the general ground that the life was not insurable at the time of effecting the assurance; or that the disclosure of the circumstances then made was not complete; or that some fact, perhaps quite immaterial, contained in one or other of the several series of questions, had turned out, on further inquiry, to be different from that warranted."

This extract clearly shows what an exorbitant degree of protection the law has thrown around insurance companies. And, notwithstanding the much-vaunted "liberality" of the directors of such companies, it is but too well known, and has been too grievously felt by many unfortunates, that even the slenderest points will be laid hold of by the "directing committee and their legal advisers" to hang some legal quibble or other thereon, by the means of which they may manage to escape from their engagements.

We will give here a few cases, selected from amongst many of the same description, as highly illustrative of the system almost universally adopted by the directors of life insurance companies:—

"ATLAS.

"The facts were, that an agent of the Atlas office, knowing that Everett possessed property determinable on the death of House, applied to the former, and recommended him to effect an assurance on the life of House. Everett informed the agent that he had never seen House, and knew nothing of him. The agent undertook to make all the inquiries demanded by the office, and to manage the transaction; and did so. It turned out that House, a handsome, athletic, and healthy-looking person, referred the office to a person in the neighbourhood, whose pills he had sometimes taken, as his medical attendant,—and not to the surgeon who had attended him when at a distance from home, when he was suffering from fits of intoxication. It was held that House had made a misrepresentation; that Everett, who knew nothing of House, was bound by that gentleman's answers; and the office succeeded in getting quit of the claim.

"ALFRED.

"We are not aware of any instance of a life assurance case having been honourably tried,—that is, tried on its real merits only; and, considering the preponderating advantages which an office possesses, in the multitude of statements and reports, the absence of the best witness for the claimants, the assured himself, and in having the custody and control of the documentary evidence, it might be expected that the company would fairly, open, and honourably, inform their opponents, before a trial took place, what were the real grounds of their objection to the claim, or their 'unfavourable impressions,' and peril their success upon establishing these objections. Such is not the practice. * * * As another example of the mode of pleading adopted by offices against their assured, take the case of Walters and the Alfred Life Company, tried at the Oxford Circuit, August 13, 1844. The office pleaded—1st. The general issue; or, in other words, they intimated that they would maintain any defence which the ingenuity of their counsel might discover, and think convenient and useful. 2d. That the assured was afflicted with paralysis at the time he effected the assurance; a plea condemnatory of their own agent and medical adviser. 3d. That the habits of life were intemperate; a plea hurtful to the character of the deceased, and harrowing to the feelings of his surviving relatives,—and proved to have been untrue. 4th. That he had frequently consulted a medical man, although he said he had not. 5th. That the policy was effected by fraud, covin, and misrepresentation; a plea destructive to the good name of the deceased, and to the character of several persons who had been applied to by the office for information as to the life, and proved to have been unfounded. 6th. That one Croft was interested in the policy, although his name was not inserted therein; the office might, with the same contempt of honour, have pleaded that the policy did not bear the proper Government stamp. 7th. That the policy was made in the name of Croft, but that he had no interest in the life of Walters: there does not appear to have been any objection to the name of Croft when he paid the premiums. The office was equally at fault in that plea, for the jury gave a verdict in favour of the claimant; and their foreman remarked that the defence had entirely failed.

"ATLAS, HOPE, PROMOTER, UNION.

"The Eagle Life Company were the plaintiffs, and the defendants were the Atlas Company, the Hope, the Promoter, and the Union Life Companies. These four companies refused to pay claims made against them on policies which they had respectively granted in favour of the Eagle Company, under the following circumstances:—Cockrane borrowed £12,000 from the Eagle, on security of a contingent interest of £16,000. The Eagle effected policies on Cockrane's life with five different offices: one of them paid the contents of their policy without dispute; and the other four declined doing so, on the ground that at the time the assurances were effected 'Mr. Cockrane was afflicted with a disease which tended to shorten life; that his habits were those of a confirmed drunkard; and that such circumstances had been concealed, whereby the policy became void.' The Eagle had themselves assured on the life to the extent of £4,000. After the evidence for the plaintiffs had been led, the defendants abandoned two of their pleas, and rested their defence upon the plea of concealment, maintaining that the habits of life of Mr. Cockrane were known to the Eagle office and concealed from the defendants, and that the policies had been thus fraudulently obtained. A number of witnesses were examined to prove acts of Cockrane's intemperance, and, if possible, to solve that question which has so often engaged judges, counsel, and juries in life assurance cases, what is intemperance; and to prove that a concealment of a material fact had occurred. The jury gave a verdict for the plaintiffs, the Eagle office.

"ASYLUM.

"The action was brought upon a policy of assurance effected on the 11th August, 1837, for £2,000, on the life of the Hon. H. G. Talbot, to whom the Reversionary Company had lent a sum of money. On Talbot's death the Asylum repudiated the policy; and the question at issue between the parties was, whether Talbot's life at the date of the policy was moderate and temperate, or the reverse? The Asylum admitted that they had been made aware that Talbot had been intemperate, and addicted to drunkenness, prior to the time when the policy was applied for, and on that account a higher rate of premium than usual had been charged for the assurance; but they maintained that the statements which they had received at the time of effecting the policy as to Mr. Talbot's then habits were unfounded. The jury decided in favour of defendants, thereby finding that the policy was void.

"LAW COURT OF EXCHEQUER, DEC. 10, 1842.

"A land agent, a gentleman of robust health generally, and accustomed to active exercise, and exposed to the weather, was in the habit of visiting London, and residing there for several weeks at a time. In the autumn of 1836 he had an attack of influenza, which left him very weak. For these sequences he consulted Dr. Johnson, his London medical attendant. When unwell in the country his medical attendant was Dr. Hawkins. Before effecting the assurance in question, he had consulted Dr. Johnson and Mr. Hale Thompson, of London, who both pronounced him an 'insurable life.' He was also examined by the medical adviser of the company, who reported him to be 'a good life.'

"In answer to the question 'who was his usual medical attendant?' he referred the office to Dr. Johnson, whom he had been in the habit of consulting when in London; that gentleman received from the office the ordinary series of questions, which he answered and returned. This was in May, 1839; and the health of the assured remained much as before, until the spring of the following year, when he fell into decided consumption, which terminated fatally in the ensuing September.

"'The Solicitor-General, for the defendants, resisted the claim, on the ground that the deceased had concealed from them, either wilfully or otherwise, the knowledge of an illness in 1837, and had improperly referred to Dr. Johnson as his usual medical attendant.'

"'Dr. Hawkins having been called, and having stated himself to have been the usual medical attendant of the deceased, at the suggestion of Lord Abinger the further progress of the case was stopped, it being his lordship's opinion, upon authority of decided cases, that a reference to Dr. Johnson could not be said to be a compliance with the requisitions of the office.'

"'The Attorney-General, counsel for the plaintiff, admitted that the witness had put his case out of court upon that plea, and, therefore, consented to a verdict for the defendants.'

"The pure question upon which the validity of the policy was made to rest was, whether the deceased complied with the rules of the company in referring to the London physician as his 'usual medical attendant,' and there was nothing in the shape of fraud, or wilful concealment, or deception, made to mingle in the reasons upon which the decision was rested.

"IMPERIAL.

"In the year 1837 Mr. John Scott, of Birmingham, a lock-manufacturer, added to his trade that of a railway-carriage lamp-manufacturer, and carried on an extensive business with most of the railway companies.

"It being essential for the purpose of this business that he should travel a great deal by railway (then a new mode of conveyance), he was advised, by several of his friends, to insure his life, as a provision for his wife and children, in case any accident should befal him. Amongst others of his friends by whom he was advised to insure his life was Mr. Charles Geach, his banker, and Mr. Henry Edmunds, the agent for

the Imperial Life-office, and he received the same advice from Mr. Barnett, the agent in Birmingham for the Norwich Union office. He obtained from Mr. Barnett, and filled up, about the month of April, 1840, the usual printed form of proposal to the Norwich Union Life-office for a policy for £2,000.

"Mr. Scott was examined by his own medical man, Mr. Thomas Williams, who had known him intimately for years, by whom the usual printed certificate of sound health was filled up and sent to the Norwich office. He presented himself also to Dr. Ingleby, the medical examiner for the Norwich office, an examiner of great care and strictness, who made an examination, and reported that Mr. Scott's was a perfectly sound life.

"It having come to the knowledge of Mr. Edmunds, the agent for the Imperial, that Mr. Scott had proposed to insure with the Norwich, he persuaded him to withdraw his proposal, stating that at the time Mr. Geach and he had advised him to insure his life it was taken for granted that Mr. Scott knew that Mr. Edmunds was agent for the Imperial Company. Mr. Scott applied to Mr. Barnett to release him with the Norwich office, which was ultimately arranged at an expense of about £6, which was paid by Mr. Scott. Mr. Scott then obtained the printed forms used by the Imperial office, and was again examined by his own surgeon, Mr. Williams. The usual certificates of sound health were filled up by Mr. Williams, and by a friend as private referee. At the request of Mr. Edmunds, Mr. Scott presented himself to Mr. Wickenden, the medical examiner for the Imperial Life-office, who made an examination, and reported that Mr. Scott's was a perfectly sound life. On the 13th of May, 1840, a policy was issued by the Imperial office for £2,000.

"From the date of the policy until the early part of the year 1842, Mr. Scott pursued his business with great activity and perseverance, and with an amount of personal labour described by his family, his clerks, and workmen, to be untiring and incessant; but in consequence of want of sufficient capital, and other causes, he became bankrupt in April, 1842.

"The premiums payable in 1840 and 1841 were paid by Mr. Scott. Another premium became due in 1842. Both the mortgagees of the policy, and the assignees of Mr. Scott's estate, believed Mr. Scott to be so good a life that they declined to pay the premium to keep the policy on foot until they had ascertained that the office value of the policy was more than the amount of the next premium; and, having done so, it was arranged between the assignees of Mr. Scott's estate and the mortgagees of the policy that it should be sold by public auction, and the premium and expenses be repaid out of the purchase money. The sale took place in October, 1842. The agent for the Imperial office bid first for the policy, and continued to bid until the biddings reached £100, and it was knocked down to Mr. Samuel Beale, a merchant in Birmingham, for £135.

"The premium due on the policy in May, 1843, was paid by Mr. Beale. On the 11th of December, 1843, Mr. Scott died.

"The certificates of the death of the assured were forwarded to the office, and at the expiration of about three months the claimant was informed by the agent that the office had 'unfavourable impressions.' To all entreaties the board declined to state what grounds they had for these impressions. After some correspondence, the office still refusing to state their objections to the claim, a suit was instituted, and the grounds upon which the office disputed the policy were first disclosed, by the pleas filed in answer to the claim in the action.

"The cause came on for trial at Warwick, before Lord Denman, at the summer assizes in 1844, and the only important witness called by the office, in answer to the evidence adduced by the plaintiff, was an apothecary from Stockport, who stated that Mr. Scott, whilst on a journey on business in May, 1836, had spit about a teaspoonful of blood in his presence; but he admitted that at the time Mr. Scott had an ulcerated throat, which might have caused the bleeding; he also stated that he did not consider it dangerous.

"The jury returned a verdict for the claimant.

"Upon technical grounds of law another trial was allowed, and then another, and at last the company paid the claim. The plaintiff was found entitled to costs, but the expense of these several trials was so great that, though successful in all the three suits, he was out of pocket almost the entire sum at stake.

"It appears from the history of this case that the directors of the company concluded that they must be successful if they proved that the assured had at any time in his life spit blood, because that circumstance had not been mentioned to them before the policy was effected. Spitting blood is a symptom of consumption; the assured had spit blood, therefore he must have been in a consumption. This was no doubt the course of reasoning pursued; and the directors were not convinced by the verdict of three sets of juries that they were wrong. A medical writer in the *Medical Times*, in remarking upon this case, says:—

"'We apprehend that very few people pass through life without spitting blood some time or other. Very many people, in certain states of dyspepsia, or disordered general health, are as subject to bleeding from the gums, the mucous membrane of the mouth, the fauces, or the tonsils, as others suffering from determination of blood to the head are liable to bleeding from the nose. And if an ignorant bystander, seeing a man spit blood, under the circumstances above mentioned, or after having picked his teeth, or chafed his gums, is to report the poor fellow the victim of hœmoptysis, and on this solitary ground an exception is to be taken to the validity of his assurance, we expect very few to be safe.'"

The remedy which Mr. Robertson proposes and advocates is to make every policy, when once granted, indefeasible and indisputable.

It might be objected that to deprive an office of the right of disputing a claim under all and any circumstances would be in a measure a positive invitation to attempts at defrauding the company. To this objection Mr. Robertson makes the following, in our opinion, perfectly satisfactory reply:—

"It may be objected that to deprive assurance companies of the power of disputing policies in all cases would leave them at the mercy of every description of fraud—that a regard for their own interest will prevent them from abusing the power by disputing just or equitable claims, but that they must have some means of protecting themselves against positive fraud. This brings the question to its true issue. Granting that policies may sometimes be fraudulently obtained, whether is it better—more fitted to give full scope and development to the manifold advantages of life assurance—that assurance companies should be tied down to a reliance upon their own care and vigilance in granting assurance—that, instead of having permission to ask a jury to say after a man is dead whether his representations have been correct, they should be required to take sufficient pains to ascertain that fact for themselves while he is alive,—and that thus a policy of assurance should have an indefeasible stamp of value so affixed to it that it can be freely and safely used for all the purposes for which such a security can be made available; or that, in order to relieve companies from the necessity of exercising vigilance and caution in the taking of risks, or at least to protect them from the remote danger of such frauds as no vigilance will guard against, the value of every policy should be liable to depend upon the issue of an inquiry, to be conducted by the holder single-handed (in many cases a widow or infant family) against a powerful and wealthy association possessing all the advantages which wealth gives over poverty in such a struggle?

"The question does not appear a difficult one to answer. Indeed, the answer has almost been given already. A policy of assurance which does not make the holder sure of receiving the amount stipulated in it is a contradiction in terms. The very object of the assurance is, that there may be no doubt as to the result. If there is to be risk after all, it would be better that each man should take the risk of his own life, and simply accumulate his savings. In all the uses which may be made of a policy of assurance—uses which are multiplying and extending every day—its value is injuriously affected by every doubt which can attach to its ultimate validity. This is, in fact, a fraud upon the assured. They pay for assurance, and they do not get it.

"A company which knows that it is estopped from disputing a policy once granted will, of course, take sufficient care to ascertain the real state of the risk before granting the policy. This, as experience proves, is not a matter of difficulty. All the facts regarding a man's present state of health and habits, which it may be possible to prove before a jury ten or a dozen years hence, may be discovered on proper inquiry now; and a company which, knowing that a policy once granted can never afterwards be disputed, will use proper precaution to secure that none shall be granted which they would have an interest to dispute.

"The remedy for the uncertainty with which life assurance is now beset and litigation such as we have described, and which, unless a remedy be provided, is likely to increase, is alike simple and efficacious. Let life companies to be formed insert in their deeds of settlement a clause prohibiting them from disputing any policy they have granted,—a clause to that effect has already been adopted by a life company, and approved by the registrar of joint-stock companies,—and let the existing companies make sufficient inquiry before granting an assurance, abolish the warranty clause, and grant unrestricted policies. The principle of the indisputability of policies is, indeed, the only one deserving the name of assurance. Wherever there must be a reliance upon the honour, or generosity, or sense of interest of others, there is uncertainty and risk. No one can tell what other feelings may come into play to prevent these from operating. A claim which cannot be set aside, or even disputed, is the only result to which a wise man can look forward with any satisfaction, as the end of the transaction on which he enters when he assures his life."

We conclude this notice of Mr. Robertson's pamphlet with the sincere wish that the company of which he is the manager may meet with the encouragement and success to which the justness and wisdom of its principles fairly entitle it.

THE CHEMICAL TIMES.

SATURDAY, JUNE 23, 1849.

THE CHOLERA.

THIS fearful scourge is now, indeed, on the point of making its appearance amongst us—with what degree of virulence will depend, in a great measure, on the temperature and on the electric condition of the atmosphere. A few weeks, or even days, of excessive heat, attended with a corresponding absence of positive electricity, would be sure to render it fatal to thousands, notwithstanding all the sanitary and sanatory measures of the Board of Health, many of which appear to us to be based upon a total misconception of the nature and character of the disease. It seems to be the rooted opinion in this country that the cholera owes its origin and existence to miasmatic causes, and that it will visit only low, marshy, ill-drained, and badly-ventilated quarters. Now, there

could not well be a greater mistake than this. The cholera is exceedingly capricious in the selection of the places which it chooses to visit, and instances are by no means rare where it has raged with the greatest virulence in high, airy, and most healthy localities, whilst it has spared the most unhealthy spots in the vicinity of the quarter of its fiercest attacks. Nor does it appear, from the experience which has been gathered during its former visits, that a strict adherence to certain dietary rules has ever proved anything like a safeguard against it.

The fact is, this strange distemper is altogether of electric origin, and perfectly independent both of miasmatic emanations and of dietary tables. We think it our duty to give currency to this opinion of ours in consideration of the numerous rules and regulations on the interesting questions, "what to eat, what to drink, and what to avoid," which have of late made their appearance. The influence of the mind over the body is, as every one knows, very considerable; the fear of being attacked by a disease acts frequently as an invite to the dreaded visitation; and a strict and anxious avoidance of certain articles of food and drink is a plain evidence of that apprehension, or, at all events, very likely to engender it. We would advise every one to continue the same mode of life and living which he may have found to agree with him for years, and, depend upon it, no one will be the more liable for that to an attack of cholera.

What we would recommend for prevention and cure is simply this:—The wearing of a flannel bandage round the abdomen, and the avoidance of iced or very cold drinks, particularly when the body is heated. In a case of attack, an insulated bedstead. This latter may be readily constructed by placing a door or a large window shutter on glass legs (strong glass bottles will answer the purpose) thickly coated over with sealing-wax, and making the bed of the patient on this improvised stead. The table intended to hold the articles necessary for the use of the patient must be similarly insulated, and an insulating-stool placed by the side of the bed. The latter must be removed on all sides two feet at the least from the wall, and care must be taken to keep the bedclothes off the ground. Let the patient eschew everything in the shape of a heroic method: a simple linseed poultice on the abdomen, and a few drops of ether in rice-water, will do more good, or, more correctly speaking, less harm, than all the opium and calomel in the world, Dr. Ritterbrandt's essential oils, or Hahnemann's camphor.

COMMITTEE ON HEALTH.

Immediately after the adjournment of the Court of Sewers for the City, on Tuesday, the committee of health sat, at which the following important report of the medical officer, which had been received on the preceding day, and agreed to, was acted upon, as regards the required assistance of the police in carrying into effect the sanitary regulations recommended for adoption:—

"Lancaster-place, June 18.

"Gentlemen,—Within the last fortnight I have found many reasons for believing that an extensive outbreak of cholera is impending. The steps of its approach are uncertain, depending probably on atmospheric variations which it is impossible to foresee; but there is no reason within my knowledge for indulging a hope that the City will continue to be exempt from an epidemic prevalence of the disease. Whether we shall escape comparatively unhurt, or shall suffer from the pestilence in the same proportion as Paris, where a week ago 600 or 700 deaths were occurring daily from cholera alone,—this is a question on which (however alarming may be the doubt) it is impossible to pronounce a decided opinion.

"Under these impressions I think it indispensable to adopt immediately every precaution that can be enforced by Parliament; that notices, addressed to landlords, and requiring them to cleanse and repair their property, should be couched in the most peremptory terms; that the shortest time consistent with law should be allowed to persons receiving such orders, and that no evasion or delay should be permitted; that in every instance, without exception or distinction, so soon as the legal term of grace has expired, the work neglected by the landlord should be given over for execution to the persons named in the act.—(Vide act.)

"Experience convinces me that the present staff of inspectors cannot, by any possibility, perform the immense amount of duty necessary at the present crisis: they may be quite sufficient for all ordinary business of the court; but on an emergency like the present, where promptitude of action is a matter of the utmost importance, their number is absolutely insufficient. For with the present staff, while each inspector proceeds in his duties of inspection from one part of his district to another, it is impossible to enforce the fulfilment of such orders for cleansing, &c., as may have been issued for the districts already inspected—impossible even to know how far those orders may have been complied with, or how far the original uncleanliness was proved. In Glovers'-hall-court, for instance, this difficulty led to very serious results, and I have little doubt that a reinspection of this locality would have prevented those ravages of the epidemic which I recorded in my last report.

"I have accordingly to recommend that for a limited time the following measures should be adopted:—

"1. That a special staff should immediately be organized, charged with the duty of going from house to house in all the courts, alleys, and poorer districts of the City, to examine into the existence of nuisances, and to report at Guildhall on the district examined according to the subjoined form.

"2. That the inspectors should, for the same limited time, confine themselves to the task of serving notices and seeing to their due execution by landlords, owners, &c., or, failing this execution, immediately to adopt such proceedings of a summary kind as the act of Parliament allows.

"Without venturing to specify the exact number of men who may be required for this job (a subject on which the court is most competent to form an opinion), I would merely beg leave to state that the matter is one of extreme urgency, and that I think the number of men to be enlisted for the purpose should be sufficiently large to bring all the poorer districts of the City within the range of a weekly survey. Thus, if the men employed were active and efficient, I have little doubt that within a fortnight this important sanitary review, and all the works of cleansing to result from it, might be brought to a conclusion, and the City be placed in a most favourable condition (of those, at least, within our present control) for resisting the attacks of disease. With regard to the class of men required for the service in question, it would be necessary that they should have sufficient education to enable them to fill up the printed forms with which they would be furnished; that they should be acquainted with the localities; that they should be in some degree accustomed to deal with the poorer classes in matters like that in hand; and (not least) that they should be persons for whose honesty and discretion some guarantee could be obtained.

"I doubt whether, in an emergency like the present, and for a purpose so essentially temporary, it would be possible to do better than obtain the co-operation of a small section of the police force; and, if the court should be willing to adopt my suggestion, I would recommend that a sufficient number of them should be employed to complete the survey of the City within a period not exceeding six days. (Here follows a table of the information to be obtained in the survey. The heads were, the name of court, alley, street, &c., the general cleanliness, the existence of a stench in a house, privies clean or dirty, cellars, any filth or rubbish contained in them, stagnant water, any complaint of nuisance.)

"During the period in which these measures might be in progress I should further propose, if it meet the sanction of this hon. court, that I should sit daily at a certain hour in this room, in company with the principal clerk, to receive the reports, to examine them one by one, to advise on the issuing of orders, to learn from the inspectors when the orders were neglected, and generally to promote, to the best of my ability, the satisfactory completion of the important measure which I have taken the liberty of recommending to the committee.

"JOHN SIMON."

THE HEALTH OF LONDON.

[From the Report of the Registrar-General.]

The mortality of the metropolitan districts, which in the previous week was rather above the average, has fallen last week to 912 deaths, or 51 less than the estimate founded on the weekly mortality of former springs. Taking four principal groups of fatal causes, namely, the tubercular, diseases of the nervous system, of the heart, and of the respiratory organs, all show a decrease on the average; especially the last, in which the deaths were 88, though the average is 131. The epidemic class alone (numbering 251 deaths) shows an excess which is considerable, and amounts to 53; but, of the 21 diseases of which it consists, only hooping-cough, diarrhœa, and cholera, are conspicuously fatal in this return. Hooping-cough numbers 45, against an average of 36; the average of diarrhœa and dysentery is 14; but in the last three weeks the numbers have been respectively 19, 25, and 38, showing a gradual increase. Cholera, which in five former springs averaged one death only, was fatal in the last three weeks to 9, 22, and 42 persons, showing that the epidemic makes some progress. Of the 42, 30 died on the south side of the river. Two men died from contact with diseased horses. One case, that of a man 48 years of age, is described as "inflamed finger (10 days), erysipelas of head and face (3 days)," caused, as the registrar was informed, by a glandered horse. Another man, aged 44 years, died of "farcy, caught from attending a farcied horse, which was shot." This person had been ill four months. Three fatal cases of privation are thus recorded:—A man of 43 years in Christ Church, St. Saviour's, "starvation, diarrhœa (3 days)." The case is certified by a medical man. A woman, 67 years of age, on whom an inquest was held, "was found dead, apparently from want," in Ratcliff; and, according to the coroner's return, the death of another woman, age unknown, in Goodman's-fields, was accelerated by "exhaustion from cold and privation." The mean reading of the barometer was above 30 inches on Thursday; the mean of the week was 29.779 inches. The temperature rose towards the end of the week, but throughout was less than the average. The highest reading of the thermometer occurred on Saturday, when it was 69° 6′; the mean of that day was 57° 6′; the mean of the week was 53° 5′, lower than that of the previous fortnight by more than 6°. On Tuesday the mean temperature was less than the average of the same day in

seven years by 10° 7′; the mean of the week was less than the average by 7° 1′.

The following are the fatal cases of cholera registered in the week ending Saturday, June 16, 1849 :—

Westminster; St. Margaret.—M. 51, "malignant Asiatic cholera (24 hours)."

Marylebone; All Souls.—On June 9, at 4, Ogle-square, lithographic printer, 21, "peritonitis (12 days); diarrhœa cholerica (3 days)." Unwholesome locality was the predisposing cause.

St. Pancras; Tottenham.—M. 52, "cholera Asiatica (28 hours)." Camden-town.—F. 76, "English cholera (about 2 days)."

Islington; West.—At 60, Gibson-square, widow of a colonel, 53, "cholera (48 hours)." The medical attendant states that "there is a foul cupboard under the stairs of the house in which she lived." Mr. J. Watts, the registrar, adds, that "deceased occupied a house in one of the open squares. The attention of the family was directed immediately after the death to offensive effluvia proceeding from the kitchen stairs, which they traced to the unused closet, or cupboard, mentioned above. In last weekly return was reported a death which occurred suddenly in the same house of a gentleman, aged 60, from cholera, after 15½ hours' illness, whose sleeping-room was partly over this cupboard. Both parties had been previously in excellent health."

Holborn; St. Andrew, Eastern.—At Holborn Union, M. 68, "Asiatic cholera (25 hours after attack)."

East London; Cripplegate.—At 5, Glovers'-hall court, F. 3, "cholera (5 days)."

West London; South.—At 6, Union-court, F. 32, "cholera (32 hours)."

Whitechapel; Whitechapel North. — The two following cases are those of labouring men, who died in New-court, George-yard:—M. 32, "malignant cholera (11 hours);" M. 51, "malignant cholera (22 hours)."

St. George-in-the-East; St. Paul.—On the 15th of May, at 6, Kinder-street, M. 34, "natural death, sudden, from cholera (5 hours)."—Inquest.

Stepney; Ratcliff.—M. 50, "sudden death from Asiatic cholera (9 hours)."—Inquest.

St. Olave; St. Olave.—On the 10th of June, at 8, Melior-street, butcher, 25, "cholera Asiatica (10 hours);" at 1, Vine-yard, a tortoiseshell-worker, M. 38, "Asiatic cholera (44 hours);" at 26, Magdalen-court, wife of a labourer, 30, "cholera (14 hours)." St. John.—M. 50, "cholera (24 hours)," under treatment in the workhouse, 7 hours; M. 17, "cholera Asiatica (24 hours);" F. 7, "cholera Asiatica (12 hours)."

Bermondsey; Leather Market. — M. 47, "Asiatic cholera (13 hours)." St. Mary.—At Mellick-place, F. 25, "Asiatic cholera (24 hours)." St. James.—M. 17, "Asiatic cholera (14 hours);" M. 22, "Asiatic cholera (16 hours);" M. 5, "petussis (3 weeks), cholera Asiatica (30 hours);" M. 25, "Asiatic cholera (18 hours);" M. 22, "Asiatic cholera (120 hours), fever (24 hours);" F. 39, "Asiatic cholera (4 days), premature labour (1 day);" F. 16, "Asiatic cholera (18 hours);" F. 11, "malignant cholera (23 hours);" F. 45, "Asiatic cholera (15 hours)." Mr. Martin, the registrar, states: "That all the nine cases of cholera reported this week occurred on the banks of the disgusting tidal ditch mentioned in last week's report. Seven of them occurred within 50 yards of each other. This ditch, formerly used as a mill-stream, is now the receptacle of all kinds of filth. Putrid fish in large quantities is frequently thrown in; many of the poor drink the water and use it for culinary purposes."

St. George-the-Martyr; Kent-road.—F. 10 months, "English cholera; convulsions."

Newington; Walworth.—On June 9th, at 7, Cancel-street, a printer, 49, "malignant cholera (12 hours)."

Lambeth; Lambeth Church (2d part).—M. 35, shoemaker, "cholera virulent (13 hours)." Brixton.—In Brixton Goal, M. a convict, 41, "natural death; malignant cholera (19 hours)." Inquest.

Rotherhithe; Rotherhithe.—F. 32, "cholera (15 hours)."

Greenwich; St. Paul's, Depford.—M. 72, "cholera biliosa (4 days)." Woolwich Arsenal.—In Unité Hospital Ship, Woolwich, M. 16, a convict, "Asiatic cholera (8 hours)."—Inquest. In same hospital, M. 32, a convict, "English cholera (6 days)." — Inquest. Greenwich, West. — In Dreadnought Hospital, M. 38, "cholera (16 hours)." In same hospital, M. 32, "cholera (12 hours);" M. 31, "cholera (24 hours);" M. 45, "cholera (20 hours);" F. 4, "cholera (15 hours)."

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Hugh Bell, of London, Esquire, for certain improvements in aërial machines, and in machinery in connection with the buoyant power produced by gaseous matter. Patent dated November 23d, 1848. Enrolled May 23d, 1849.

This invention relates to improvements in aërial machines, and in apparatus to be used in connection with the buoyant power produced by gaseous matter contained in a balloon or bag; and also in aërial machines which do not require any such sustaining power. With reference to the balloon motor machine, this, in its complete form, is composed, in the first place, of a buoyant apparatus; secondly, of a framework and car, to one of which is attached an apparatus capable of producing motive power; thirdly, of a guiding or steering apparatus; and fourthly, of apparatus for arresting the progress of the machine, either over water or land.

In the balloon motor machine the balloon or bag containing the buoyant gas is construeted of an elongated form, having its greatest length placed horizontally, or in the direction in which it is to travel, no matter whether the form be pear-like, or that of two cones placed base to base, or a cylinder with cones at the extremities, or any of these forms flattened laterally or vertically. Any one of these forms presents very considerable diminution of resistance to the atmosphere on being propelled through it in the direction of its length, as compared to the usual form of the ordinary balloon.

There are one or more membranes contained within the balloon, which the patentee denominates septum membranes. If a single one be used, it is to be placed aeross the cavity of the balloon, and attached all round in a horizontal line to about where the upper and lower halves of the balloon membrane meet, or somewhat below this; it should be sufficiently loose to admit of the balloon being distended with buoyant gas above that membrane, without interfering with its eapacity, further than by its own thickness, which, of course, would be very trifling. This partition membranc is shown in onc of the engravings which accompany the specification. In this engraving it is seen close to the lower half of the balloon, the situation it would occupy when the cavity above it is distended with gas, having little or no atmospherie air beneath it or between it and the lower half of the balloon. The only other attachment it would have is at the bottom part of the balloon, where the rope from the top "emptying valve" passes the "safety gas valve," to be in reach of the aëronaut; this should be a cylindrical passage, supported by hoops, so as to prevent any possibility of the membrane becoming jambed, and fouling the valve rope. The emptying valve might be situated elsewhere, as at the after extremity of the balloon, above the septum membrane, to be acted upon by a rope from the outside. In this case the hooped part of the partition membrane would be unnecessary, and it would be left attached by its margin only. The septum membrane should prevent, as much as possible, all communication of atmospheric air (if any were beneath it) with buoyant gas above it. If a balloon with this partition membrane be filled with gas above the septum, to about three fourths of its contents, and the remaining quarter beneath the septum with common air, so as to distend it, the balloon may, at moderate, and at the same time variable, elevations, always be kept tense, without any escape of gas being necessary; for, on the expansion of the whole contents of the apparatus while ascending in the atmosphere, it is so arranged that all the atmospheric air beneath the septum would escape before any of the buoyant gas could do so from the balloon above. This is effected by means of a valve constructed so as to open at a much lesser pressure than the safety gas valve. On approaching the earth the buoyant gas would again become condensed, causing the balloon membrane to become lax, to counteract which atmospheric air should be injected by a blowing machine, or other suitable apparatus, into the space beneath the septum, from which it has been suffered to escape, and thus obviate the otherwise flaecid state into which it would fall; and, if this septum be nearly equal in extent of surface to one horizontal half of the balloon, it may be kept tense longer than there could possibly be sufficient buoyant power to support the machine in air. The object of this arrangement is to facilitate the rapid motion of a large machine of this kind through the air, and without which it would be impracticable, as will be evident to any one who has seen a half-filled balloon bag with the wind, under which circumstance any propelling power would, if attempted, be attended with considerable danger to the balloon. The air-injecting or filling apparatus may be either a large light syringe, with valves, or an apparatus similar to the patent bellows, fitted with a single valve, to be worked by the hand, or by some other driving power. The septum, having no tension to resist, but merely to prevent the buoyant gas and atmospheric air becoming diffused or intermingling with each other, may be so thin as to weigh but a few pounds.

The patentec here states that if the propelling power be efficiently applied to one of the forms of buoyant machines above mentioned, in its distended state, it would easily compensate for several pounds above the weight of the arrangement of apparatus just described, by the increased easc with whieh it would pass through the air on being propelled obliquely upwards. It would never be requisite to take up any atmospheric air in the space between the septum and the lower half of the balloon; it is only to be forced in when the balloon is collapsed from a deficient quantity of gas. The buoyant gas gradually escaping from this machine while ascending in the air may be made use of to heat the water to produce steam, should such be used as the propelling power. The membranes used in the construction of the buoyant apparatus should be of such material as may be mest fitted to prevent exosmose and endosmose, combined with the greatest possible lightness; silk, or preparations thereof, will answer the purpose best.

In place of the netting (in common use for strengthening the balloon, and affording an attachment to the framework or bar) the patentee employs flat straps or bands. These bands are plaeed longitudinally and transversely round the balloon (or diagonally, if great strength be required) and stitched where they cross one another; or they may be so woven. By this arrangement the advantages gained are greater strength, more equal strain, less resistance to motion through the air, and less chafing to the silk or membrane containing the buoyant gas, which chafing is very considerable from the knots of the netting in common use; the patentee also applies a single strong band attached all around at the central horizontal line of the balloon, and also to the corresponding inside part of the flattened bands, so that this band is attached by both margins. There should be a

laeing in the centre of this band, all the way round, so that when the "flat band netting" is separated from the balloon it may take one half of the band, and the balloon the other half. This separating band should be so broad as not to interfere with the ordinary relations of the balloon and its netting. The great advantage of this arrangement is this: suppose, while in the air, all the gas was suddenly let out by the bursting of the balloon, with or without rupture of netting above, the impulse towards the earth would cause the lower half membranes to rise and fill or bulge like a parachute, and thereby considerably diminish the chances of accident.

One of the engravings which accompany the specification represents a vertical section of an improved valve apparatus used in ballooning. In this representation it is supposed to be in the situation of that in which the valves are placed in the ordinary balloon, and to be acted on by the aëronaut by means of a rope attached to the lower plate. The ring here used in place of the common one, to which the netting and silk are attached, is composed of two rings serewed together, and at the same time that it bites the fixed plate or ring of the apparatus it is intended to bite the silk or membrane of the balloon; between the surface of the fixed plate, which forms one face of the valve, and that opposed to it, is a ring of vulcanized indiarubber or leather attached to one of the valve surfaces; this forms the moveable plate or valve; to the fixed plate or ring are secured three bridges, to which loops of vulcanized indiarubber or springs are attached; these loops connect the bridges with the moveable valve plate, to which they are fixed, their action drawing the plate upwards, so as to close the opening completely. The patentee describes also a much simpler arrangement, in which the ring, plate, and bridges are all in one. The valve plate is larger, and the part against which it would press is the beading on the under surface of the ring, which should be as thin as is consistent with the strength required, and sufficiently deep to allow the springs to act freely. Through the collar, which is bored true with the face of the valve, passes a sliding rod or tube fixed to the moveable valve plate; the head at the top of the rod prevents its slipping through the collar. If the sliding piece be of tubing, with most minute holes in its surface, and a little oil be kept in it, the sliding motion will be effected in the most perfect manner.

The valve apparatus may be made of brass or iron, and the ring piece or pieces of the same material; but wood may be equally used for this purpose. Two valves of the above kind may be used in combination, more or less modified, so that the one acts as a safety valve, at the same time that the other may be used as an emptying valve. Instead of employing three springs for the purpose of closing these valves, one central spring only may be substituted between the head of the bolt and the collar in which it slides, which will have a like effect.

The "framework" of the balloon motor machine is composed of metal tubes, placed in a longitudinal direction, more or less parallel to the under surface of the buoyant machine, at such distances from one another, and having diagonal pieces of the same so placed between them, that the greatest possible strength and stiffness may be combined with the greatest possible lightness. This frame should be of the greatest strength where it corresponds to the body of the buoyant apparatus, so as to sustain the force of the impinging or propelling machines; it should taper at the same time that it curves towards the ends, and, as it approaches either apex of the cone, at the extreme ends, a single tube may suffice.

Although a frame adds somewhat to the weight, it very considerably increases the safety and convenience of the whole machine, by giving attachment to all machinery (which would otherwise encumber the car or boat when in the water), by rendering the strain more equal, by supporting more effectually the relative positions of the balloon membrane and netting; and, in case of a rend, by assisting to form a much more effectual support, by keeping the temporary parachute before mentioned extended; it also renders the detaching of the car or boat, in case of accident over the sea, much less difficult, by having more rigid points for the tackles to lower the boat from.

The car is formed so as to fulfil the purposes of a canoe or boat; it is placed parallel to, and fastened beneath, the buoyant apparatus by the bands before mentioned, if there be no framework; or, if there be a framework beneath it, it is attached thereto by tackles, from which it is readily cut away when required. The boat should be composed of the lightest and strongest material in combination, as sheet iron, or other metal; or of a frame of tubing or basket-work, covered with gutta percha, or any other material impervious to water, or made simply of gutta percha. It should have air-tight cavities at each extremity, with openings in them above, to be closed only when in water, so as to be used, should there be occasion, as a lifeboat. In constructing this framework the tubing is curved to the proper shape, the diagonal and other stays being connected to the main framing by knee or angle pieces, in the ordinary manner of connecting gas tubing; each knee piece being formed of the proper angle to effect the requisite connection. In the construction of impinging machines for propelling, one of the best forms is that made on the principle of the common screw propeller used in steam-vessels, one or more of which may be used. The axis or axes should be parallel, or nearly so, to the axis of the buoyant apparatus. The materials used in the construction of a screw may be various, as the frame of metal, tubing, wire, and rods, covered with silk, sheet metal, or papier maché. If two propellers are used, they may be placed one on each side, and acted on from the bar or framework by an endless cord. If but one screw may be used, it may be situated either beneath or behind the car, boat, or framework, to be worked by any convenient power.

Other forms of propelling are given, but the patentee believes that the most generally useful propelling machines will be found to be those made upon the principle of the screw, and for these reasons: they may be made lighter, their motions are continuous, and not alternating, and there is little comparative loss of power; they are less likely to get out of order, and, if they happen to do so, they may be much more easily repaired; and greater rapidity, he thinks, is to be obtained with them. In propelling aërial machines through the atmosphere, it is necessary to employ some apparatus for guiding their movements, which he terms the steering or tail apparatus (from its similarity to the tail of a bird), which has imparted to it two motions, the one a hinge motion, and the other a rotating motion, combined for the purpose of obtaining the necessary movements of an extended surface or fan, more or less approaching to those of the tail of a bird, so that the guiding or directing the whole machine when in motion, in every direction, may be at the command of the aëronaut. The tail apparatus is composed of a frame more or less in the form of a bird's tail, over which some membrane may be stretched; or it may be made wholly of metal. This frame is moved upon a hinge joint by means of a running cord or chain passing from either surface of the tail fan over pulleys on the ends of two branches of tubing, and down into an axis tubing, thence through which it is conveyed, and fixed finally to the periphery of a wheel situated at the extremity of this tubing; or it may be in the car or boat; by these means a complete hinge motion is obtained. By turning this wheel on its axis by a handle, in either direction, the one cord will be taken up on the periphery, while the other will be slackened out, causing the extremity of the tail to depart from the straight line. The partial rotation of the whole tail apparatus just mentioned is effected by the motion of a small lever attached to the tubing axis, on which the hinge of the tail fan works. This tube is rotated by moving the lever to either side, and hence it is called the axis tube. Two ratchets or fixing wheels, for the purpose of securing the tail in its different positions, are attached to the wheel, which is held at any required point by a click, which adjusts the position of the tail on its hinge motion (as before explained) by cords; while the one of the ratchet wheels, with its tube, affixed to the framework secures the whole apparatus in any position obtained by its rotation with the axis tube, also by means of a click.

The results from the above combinations of the "hinge motion" and "rotary motion" are, that the fan may be made to bend on its hinge in any direction of a circle, viz., up or down, or laterally, or in any diagonal of these motions; consequently the direction of the whole machine, when moving sufficiently for steerage through the atmosphere, may be changed upwards or downwards, to either side, or to any diagonal of these, on the same principle as the bird directs its course by the motion of its tail.

The patentee's improvements in machines for arresting motion in aërial machines over the surface of water or land consist of—First, an apparatus which he terms a "water grapnel": its general form is that of an umbrella; the ribs are made of iron, brass, or metal tubing, and the covering, which is fastened firmly to the ribs, of very strong cloth, prepared so as to be impervious to water. The ribs are hinged at one end, and connected at intervals by stout cords to the collar at the neck of the centre rod, so as to prevent the ribs opening more than to a certain extent, as in the ordinary umbrella. To the short end of the rod above the collar a strong rope is attached by which the balloon is moored. The ferrule end, or that at which the ribs are hinged, is lengthened, and of solid metal, while the rod is of tubing. Another small rope is attached to it at the extremity of the weighted end. When it is intended to arrest the progress of a balloon as much as possible while at sea, this machine is to be collapsed and tied up like an umbrella, but with a thread or slight cord that will easily break. The apparatus is now to be let down rapidly by the larger rope, the smaller one being slack; the heavy end descends first, and is carried deeply into the water before the aërial machine can ascend much from the diminution of weight produced; the moment that the rope becomes tight, the thread round the umbrella will give way, when it opens, and immense resistance to its passage through the water is produced by the body of water it contains. The aërial machine may now, in fact, be said to be moored to the water. When it is wished to haul the "grapnel" up again, and to proceed, the great rope is to be slackened and the small rope to be hauled upon; by this, the "water grapnel" has its ends reversed, when it collapses; and the only resistance to its being hauled up is its own weight, and the friction arising from its passage through the water. It may be observed, that a grapnel, either for water or the common one used for land, should be dropped, if possible, while the aërial machine is kept, as nearly as possible, over the same spot. Again, the grapnel-rope, whether for land or water, should have a long piece or pieces of vulcanized caoutchouc of its whole breadth, or one or more springs, proportionably strong, or the rope should be of an elastic material; by these means the sudden jerk occasioned by "bringing to," which is felt in the common rope from the ordinary balloon, when the wind is fresh, will be in a great measure prevented.

When steam power is used, the generation of steam from water may be produced by the ignition of coal, spirit, ether, oil, or gas, or other hydrocarbons; the gas may be brought by a tube from the balloon to beneath the boiler; the laxity which would arise from the escape of gas being counteracted by forcing atmospheric air into its proper receptacle by the apparatus already mentioned. Now, suppose that there is a large quantity of ballast, in the shape of coal, or

any inflammable fluid for the production of heat, applied to water, to produce steam by the consumption of the coal and water, the balloon, becoming specifically lighter, would rise in the air; the consumption of coal or inflammable fluid should now cease, and the gas be allowed to pass through the tube to be ignited beneath the boiler; as the balloon becomes lax, air must be pumped or injected into its proper receptacle; after a time, the balloon would gradually diminish in buoyant power, until, if allowed, it would sink to the ground; if, at this time, water be required, a small quantity, so as not to increase much the specific gravity of the machine, may be caught up by a bucket, the machine being made to oppose the wind, so as to keep it for the time over the water as stationary as possible. The coal or fluid ballast is now to be made use of, if the machine has a tendency to descend; it may be kept up by being propelled in an oblique direction upwards, until, by the use of the ballast, the specific gravity has become equal to the air it is moving in. The discharging only a portion of ballast or gas alternately, by using it to produce heat for the generation of steam, carried to a very slight extent, would be sufficient, in most cases, to get into any current of air, or even to pass to the trade winds, to be carried a considerable part of the way towards its destination, without incapacitating the machine from returning to the same means again and again, in case of adverse winds, until it could arrive at its destination, or obtain a supply of fuel or gas from a station. The patentee observes that in taking two or three miles of atmosphere upwards from the surface of the earth there are various currents in different directions; this is not necessarily the case, but, he believes, is most frequently found to be so; under the circumstances it would be necessary only to pass from one current to another, until one was found more or less fair, and to keep in this current without propelling, if it were of the same specific gravity as the machine; or, if not, to use such propelling power as, by steerage, would keep the machine in this favourable stratum; often would the current be sufficiently fair to carry along the machine for a considerable time, without any propelling power, until another current was met with on the same level, or one passed into either above or below, which would counteract any previous deviation of course. It is not absolutely necessary that the buoyant power should in all cases be sufficient of itself to support the machine in air without the propelling power; but it should be sufficient to prevent concussion on alighting on the ground to cause injury to passengers or to the machine. The propelling power, when in action, would be sufficient to keep the machine up, when the latter is steered in an oblique direction upwards by the helm or tail, even if there should be considerable deficiency of buoyant power; but, if the propelling power were to cease, the machine must at once descend to the ground. There would, certainly, be considerable difficulty in stopping at different places when the wind was high; the same amount of wind which admits of a common balloon being retained on the ground previous to starting, also admits of the balloon motor machines being retained by the grapnel, especially as its form is better adapted for admitting of its passing more easily through the atmosphere; the propellers, also, would assist much, and would, when in action, according to the resistance from the wind, in most cases be quite sufficient to enable the balloon motor machine to remain over the same spot of ground. The detaching of the boat from the framework is to be effected at sea by using the water-grapnel, lowering away the boat by means of tackles, and then, on a favourable opportunity offering, when the boat has just arrived at the surface of the water, in the descent of the balloon, suddenly to detach both tackles (the use of one only, if possible, is much to be preferred); the balloon should be retained if it will assist in the direction of course required (provided it be sufficiently sound to retain gas), by means of a rope at the head of the boat, or, if not, all the gas should be let out of the balloon, which should be stowed away inboard. Recourse should be had to detaching the boat only when some accident had happened, so as to render it not sufficiently buoyant or safe.

The second part of this invention relates to what the patentee terms a parachute motor machine, which is composed, firstly, of a large expanded surface, which, although not a buoyant machine, presents a great surface for resistance to the air in its downward motion through it; this may be called the "parachute expansion;" secondly, of a framework boat or car, to one of which is attached a locomotive or motor machine, by which motive power may be produced; thirdly, of a guiding or steering machine, as described with reference to the balloon motor machine; and fourthly, of machines for arresting motion over sea and land, also described under balloon motor machine.

The improved parachute expansion is modified in its form from the ordinary parachute, so as to adapt it better for passing through the air (although, in its old form, it is capable of being propelled with considerable velocity); this modification is effected by making all the lines of its surface, fore and aft, horizontally straight (if at all out of the straight line they should approach more or less to the arched form of those in the common parachute); this arched formed in the longitudinal direction will be found to be the best adapted for great strength and great resistance to downward motion through the air, but the objection to it is, that in rapid motion it has considerable tendency to turn downwards in front; but the patentee believes that this may be overcome by the action of the tail, and by proper ballasting. The form he prefers for the expansion is such that it may offer as little obstruction as possible to motion forwards or backwards through the air. The arched form, with its concave surface downwards, is still retained in the lateral direction, for this gives the greatest strength, at the same time that it affords considerable resistance to downward motion through the air, whilst its ascent or descent is effected by inclining the expanded surface more or less to the horizon during its propulsion through the air; the propulsion being effected in the manner before described with reference to the balloon motor machine, and also guided by the tail, as in that apparatus.

The patentee claims as of his invention:—

First. The application of metal tubing or tubes in the construction of a framework for balloons or balloon motor machines, and also the use of framework in such machines, as described.

Secondly. He claims the forming of the balloon or buoyant part of balloon motor machines of an elongated form, which elongation is in the direction in which it is propelled through the atmosphere, such direction being more or less inclined to the horizon, for the purposes and in the manner hereinbefore described.

Thirdly. He claims the application of one or more flexible partitions, which he terms the "septum membrane," to balloons, for the purposes hereinbefore described.

Fourthly. He claims the use of the horizontal band in its office of forming a parachute of the balloon, as described and represented.

Fifthly. He claims the use of flat bands as a network for enclosing the balloon by which the car or other framework is attached, or for the purpose of strengthening the balloon membrane.

Sixthly. He claims the use of a boat in balloons or balloon motor or parachute machines, when such boat is constructed so as to answer the purpose of a boat when in the water; and also the use of a boat constructed on the principle of the lifeboat.

Seventhly. He claims the application of impinging machines, constructed on the principle of the screw, or any modification of the same, as a propeller to the form of balloon expressed in the second claim.

Eighthly. He claims the application of a rotary motion in conjunction with a hinge motion, for the purpose of producing motion in the fan or blade forming the tail, which motion is more or less assimilated to that of a bird's tail, in order to effect the steerage of the different machines.

Ninthly. He claims the application of the principle of the umbrella in the water-grapnel, for the purpose of arresting the motion of balloon or other aërial machines; and also the application of elastic ropes to grapnels, either for land or water, and which elastic ropes may be formed entirely of elastic material, or by introducing some elastic material or metal spring in its length.

Tenthly. He claims the application and use of metal tubes in the construction of machines made upon the principle of the parachute.

Eleventhly. He claims the application of valves as applied to balloons or buoyant apparatus as hereinbefore described.

Twelfthly. He claims the application of the archimedean screw, or any modification of the screw or other impinging machine or propeller, to the propelling of a machine through the atmosphere, which machine will act as a parachute, or have the effect of an expanded surface, ballasted, so as to break its fall through the air, in the event of the cessation of the propelling power, as hereinbefore described.

Lastly. He claims the use of metal tubes in the construction of any of the parts or appliances of aërial machines.

George Armstrong, of Newcastle-upon-Tyne, Esq., for certain improvements in steam-engines. Patent dated December 2d, 1848; enrolled June 2d, 1849.

This invention relates: First, To improvements in steam-engines generally. Secondly, to improvements in such engines as are intended for locomotion on railways. With regard to the first part, one improvement consists in the application of a valve and suitable passages in the pistons of steam-engines, so that the steam, entering the cylinder on either side of the piston, shall have free ingress to the interior of the piston, in order to subject the back of the packing to the same degree of pressure as the exterior circumference, thereby maintaining an equilibrium, and preventing the packing either being forced back by the pressure of the steam, or subjecting it to any undue amount of friction from the pent-up steam that may have found access to the interior during the previous part of the stroke. This object the patentee effects by means of a ball clack, situated midway in a small passage direct through the piston, having another passage from the enlarged portion forming the valve seat to the interior of the piston. On the steam being admitted on the under side of the piston, it immediately forces the valve from its under seat into the upper, and, opening a communication on that side to the interior, at the same time closing the upper passage, in which position it will be maintained during the full length of the stroke, and thereby produce the desired equilibrium; the position of the valve being simply reversed, by the admission of steam on the upper side, and effecting the same object.

The second improvement consists in the adaptation of relief valves to the passages of steam-engines, to admit of the ready escape of any water that may remain in the cylinder by condensation or otherwise. This is shown as adapted to piston slides, in which the steam is admitted between two pistons working in a cylinder, having the ports cut therein. Passages are cut in the side of the slide cylinder, directly opposite the steam-ports, in which passages the relief valves are placed, and are kept up to their seats by the pressure of the steam admitted at the back, through suitable channels. A number of holes are perforated through the packing-ring of the valve piston, so that, on any pressure taking place on water contained in the steam

cylinder, it will be passed laterally through the valve piston, and away through one or other of the relief valves before mentioned, thus avoiding any injurious concussion that would arise.

In locomotive engines, instead of the ordinary cylindrical horizontal tubular boiler, the patentee employs an upright boiler, of a rectangular form, having upright tubes. This boiler he places at the back end of the locomotive, or behind the driving axle, while the cylinders are quite in front, the whole of the intervening space being enclosed by a platform, which also extends round the boiler, enabling the driver to pass readily to any part of the engine, to the working parts of which he has access through suitable traps in the platform, immediately under which it is situate. The boiler is extended beyond the limits of the side framing, above that point, in order to give more room for the steam. It is, as before mentioned, of a rectangular form, having numerous stays from the sides, which pass through spaces between the tubes left for that purpose. In order to prevent priming, the patentee forms a collecting channel around the upper part of the boiler, in the angle formed by the junction of the side stop-plates. This collector has a slit throughout its length, by which the draught of steam is equalized over the steam space. The steam, instead of being passed at once to the cylinders, is admitted to what the patentee terms an "equalizing chamber," for the purpose of equalizing the draught of steam from the boiler, producing less tendency to prime than when drawn direct from the boiler. The waste steam, instead of being used to force the draught in the chimney, is employed in heating the feed water, by passing it through tubes surrounded with water, whence it escapes freely by a separate funnel to the atmosphere. In order to force the fire, the patentee creates the necessary draught in the chimney by admitting a jet or jets of steam direct from the boiler into the chimney, in a similar manner to the ordinary blast-pipe; the jet or jets being regulated by suitable stopcocks, according to the draught required. Annular rings are also placed in the chimneys (two being employed in these boilers, in order to give the required area, without exposing too great a surface), which rings are capable of motion, similar to the ordinary throttle, by turning which the area of the funnel is increased or decreased; the rings, when in a horizontal position, limiting the passage to the opening in the centre. The cylinders of this engine are, as before stated, placed in the front of the engine, as near the centre as possible, for which purpose the patentee casts them in one piece; the object being to prevent, as much as possible, the side sway of locomotive engines. Instead of simply using hand levers for the purpose of altering the slot links of the eccentric rods, he proposes to use screw power, as being more regular and better in its action.

For the purpose of collecting sediment in locomotive boilers, the patentee applies two large tubes to the back part of the boiler, which descend nearly to the bottom of the firebox; they are fixed thereto a little above the lower tube plate, and are so fitted as to be readily fixed or removed. These tubes constitute still-water receptacles, into which the mud or sediment becomes deposited, and when filled are to be removed and emptied. The action of still-water receptacles in collecting sediment being well known, it will be unnecessary to describe it here.

The patentee claims: First. The application of a ball clack, or other equivalent valve, to a steam-engine piston, for the purpose of maintaining an equilibrium between the back of the metallic packing and the pressure of the steam in the cylinder, thereby preventing any undue pressure on the packing and the friction consequent thereon.

Secondly. The application of a relief valve to the passages of steam-engine cylinders, for the purpose of preventing the injurious effects arising from the shocks occasioned by the concussion of the piston on water remaining in the piston at the termination of the stroke.

He claims for steam-engines, so far as relates to locomotive engines: First. The application to such engines of upright tubular boilers, of form other than cylindrical, having their sides supported by stays, from side to side, through spaces between the tubes, left vacant for that purpose, by which means the said boilers may be sufficiently strengthened to allow of their being used of a quadrangular or other form, affording a larger space for the introduction of tubes than can be obtained when the form of the boiler is cylindrical, or such as not to require the use of stays.

Secondly. The application to such engines of upright tubular boilers, having the upper widened beyond the limits imposed by the lower part, by the restriction of the space by the side frames and wheels, for the purpose of obtaining a greater amount of steam space.

Thirdly. The employment of what the patentee terms a "steam collector," in the angular space formed by the upper and side plates of upright tubular boilers, as applied to such engines, in order to gather the steam over an extended surface, and beyond the ebullition.

Fourthly. The application to steam boilers of what he denominates an "equalizing chamber," for the purpose of neutralizing as much as possible the irregularities in the draught of steam from the boiler to the cylinder, and thereby lessen, or altogether prevent, the tendency to priming.

He further claims the improvements embraced under the following heads as part of his invention, in so far as regards the application of the same to locomotive steam-engines adapted for railways, but only laying claim to such when applied in combination with upright tubular boilers:—

First. Placing the driving cranks between the boiler and cylinders.

Secondly. The producing the necessary draught of air through the fire by a jet or jets of steam, supplied direct from the boiler, and projected into the chimney in the direction of the current of air required to produce the draught.

Thirdly. The employment of the exhaust steam from the cylinders to heat the feed water in its passage to the boiler.

Fourthly. The employment of piston slide valves for the purpose of alternately opening and closing the induction and eduction passages to the steam cylinder.

Fifthly. The employment of a screw power, for the purpose of lifting and lowering the slot links, for working the valves from the eccentrics.

Sixthly. The employment of closed vessels, fixed externally on the boiler, and communicating with the interior thereof, somewhere below the water level, so as to form still-water receptacles, for the purpose of collecting sediment, on well-known principles.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING JUNE 14TH, 1849.

Joseph Samuda, of Parliament-street, Westminster, gentleman, for improvements in obtaining motive power, and the machinery or apparatus employed therein; which machinery or apparatus may be used for raising liquids. Patent dated June 9th, 1849; six months.—(Communication.)

William Preddy, of Taunton, in the county of Somerset, watchmaker, for improvements in watch keys, and other instruments for winding up watches and other time-keepers. Patent dated June 12th, 1849; six months.

Joseph Wade Denison, of New York, gentleman, for improvements in engines for raising or forcing liquids. Patent dated June 12th, 1849; six months.—(Communication.)

Michael John Haines, of John-street, Commercial-road East, leather-pipe maker, for improvements in the manufacture of packing for steam-engines, cylinders, and other purposes; parts of which improvements are applicable to the manufacture of waterproof fabrics and leather. Patent dated June 14th, 1849; six months.

TO CORRESPONDENTS.

ERRATUM.—At doctrine 11 of Mr. Coxworthy's paper, No. 146, page 2, *for* on this principle "are based *many* plans," *read* "are based *my* plans."

"Galen."—University College would answer your purpose best. We think it will require about three years' attendance at lectures, &c. The amount of fees, &c., you may ascertain by applying at University Hospital. The examination at the hall is generally considered to be more searching than that at the College of Surgeons.

"Enquirer, Glasgow."—The wood or cloth which it is intended to paint upon is prepared for the process by rubbing it over with wax, and holding it then over or before a fire, to make the wax melt, diffuse itself, penetrate the texture, and fill up all the interstices, so as to form a perfectly smooth surface. The material for painting is prepared as follows:—Melt one ounce of white wax in a glazed earthen vessel, over a slow fire; add in small quantities at a time one ounce of powdered mastic, stirring the mixture all the while, until the whole of the mastic is dissolved and thoroughly incorporated with the melted wax. Pour the mixture now into cold water; when it has got hard, remove the adherent water by means of blotting-paper, and reduce the hard and dry mass to powder in a Wedgewood's mortar. Mix this powder with the colours in a strong solution of gum arabic. Light colours require only a small quantity of the powder, darker colours require more of it in proportion to their degree of darkness; black requires almost equal proportions of the powder and the colour. Mix always only as much of the colours as you think you can use before they get dry. Paint now with plain water in the same way as in painting in water colours. Take care to have the painting highly finished, otherwise the tints will not appear united after the varnishing of the picture. When the painting is quite dry, brush it over with a hard brush, dipped in melted white wax; hold the painting subsequently to the fire, in order to obtain a perfectly smooth surface of the wax. The following is the varnish mostly used for encaustic painting:—

Take of White wax, 1 part.
Oil of turpentine, 2 parts.
Mix with the aid of heat.

"Mr. Mayne."—The article in question is prepared by a secret process.

"M. L. C."—We cannot advise you in the matter.

"A Chemist."—From 5s. to 12s. per ounce. At 8s. per ounce the quality is very good, and, at all events, such as will fully answer your purpose. To the second question—no.

"Mr. W. X. Millar, Leeds," is referred to No. 128 of the *Chemical Times*.

"An Apothecary."—Your wish has been complied with.

"B. T."—Send us a sample of the article (about two or three ounces).

"A Perfumer."—The so-called "Esprit de Suave" is prepared as follows:—Take of essence of cloves and of essence of bergamot, of each 1½ drachm; neroli, ½ drachm; essence of musk, an ounce; rose-water, spirits of tuberose, and rectified spirit of wine (spiritus rectificatissimus), of each 1 pint; spirits of jasmin and cassia, of each 1 quart. Dissolve the several essences in the spirit of wine, add the other spirits to the solution, mix thoroughly, and add lastly the rose-water.

"A Subscriber."—Yes. To the second question, 25s. Taylor and Walton are the publishers.

"Enquirer."—The National Vaccine Establishment, Pall-mall East (College of Physicians).

THE CHEMICAL TIMES is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentleman may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary or scientific communications to be addressed to the Editor, 320, Strand.

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ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXII.

(LECTURE XCV.)

VEGETO-ALKALIS—(*Continued*).

BARK—(*Continued*).

PHARMACEUTICAL PREPARATIONS OF BARK.

SECTION III.—PRODUCTS OBTAINED BY THE ACTION OF ALCOHOL UPON BARK.

Alcohol, if not too highly concentrated, is an excellent solvent for the kinates of quinine and cinchonine; it dissolves also the combinations of the two alkaline bases with the cinchona red.

ALCOHOLIC TINCTURE OF BARK.

Take of Pale bark, 1 part.
Alcohol at 56 C. (21° Cartier), 5 parts.

Let the bark macerate in the alcohol for fifteen days; strain with expression; filter.

Alcohol of 56 Cent. is the best adapted to effect the solution of the active principles of the pale variety of bark. M. Personne has experimentally demonstrated that four parts of alcohol are sufficient for the purpose. I have, however, here retained the original proportion (five parts), for the sake of uniformity in the formulæ for alcoholic tinctures.

For the yellow bark alcohol of 80 Cent. answers better than that of 56 Cent.

The red variety of bark comports itself analogously to the pale variety; alcohol of 56 Cent. answers best. There is, however, this difference between the two varieties in this respect, that five parts of alcohol dissolve a larger proportion of the active principles of red bark than four parts.

The alcoholic tincture of bark is a very energetic medicinal agent.

ALCOHOLIC EXTRACT OF BARK.

Take of Pale bark, any quantity you like.
Alcohol of 56 Cent. (21° Cartier), a sufficiency.

Reduce the bark to powder; moisten this with one half its own weight of alcohol, and pile it then rather compactly in a suitable apparatus; at the end of twelve hours lixiviate with three fresh parts of alcohol. Displace the alcohol finally by water, taking care to stop the operation the moment that the liquid flowing from the apparatus creates the slightest appearance of turbidity in the first products. Distil the alcoholic liquor obtained, and evaporate the residue of the distillation to the consistence of an extract.

Pale bark yields the one eighth part of its own weight of alcoholic extract.

This extract contains the whole of the active principles of bark, for which very reason it is only imperfectly soluble in water.

SACCHAROLATE OF BARK.

Take of Alcoholic tincture of bark, 1 part.
Sugar, 8 parts.

Pour the tincture over the sugar, mix intimately; dry the mixture in the stove, and reduce to powder.

RESIN OF BARK.

Take of Bark, any quantity you like.
Alcohol at 80 C. (31° Cartier), a sufficiency.

Exhaust the bark with the alcohol, and distil off from the product the whole of the spirituous part.

Treat the residue with 20 to 30 parts of lukewarm water. Pour off the liquid part (which holds in solution the kinates of quinine and cinchonine and the colouring matters soluble in water), and wash the undissolved deposit (which consists of the fatty matters and the chinchona red, the latter, at all events a portion of it, in combination with the larger proportion of the alkaloids of the bark) repeatedly in cold water. Dissolve it now in a small quantity of alcohol, and evaporate on dishes in the stove until the mass is dry and brittle.

This so-called "resin of bark" is a very energetic preparation, which I have seen employed most successfully against intermittent fevers in marshy localities.

COMPOUND TINCTURE OF BARK.

(*Huxham's Wine.*)

Take of Red bark, 64 parts.
Bitter orange-peel, 48 parts.
Virginian snakeroot, 12 parts.
Saffron, 4 parts.
Cochineal, 3 parts.
Alcohol of 56 C. (21° Cartier), 1,000 parts.

F.S.A.

SECTION IV.—PRODUCTS OBTAINED BY THE ACTION OF WINE UPON BARK.

WINE OF BARK.

Take of Pale bark, 1 part.
Burgundy wine, 16 parts.
Alcohol at 56 C. (21° Cartier), 2 parts.

Pound the bark, pour the alcohol over it, and twenty-four hours after add the wine. Let the whole macerate for eight days; strain, and filter.

MM. Boullay have suggested the preparation of the wine of bark by the method of displacement. They stop the operation when they have obtained exactly one kilogramme of product per kilogramme of wine used; this result, however, cannot be attained without part of the water employed to displace the wine mixing with the product, to the great detriment of the preparation. It is unquestionably very desirable to avoid as much as can be done loss of substance; but the pharmacien should never sacrifice the purity and excellence of his products to economical considerations. Moreover, in this instance the loss of substance may be prevented in a great measure by a very simple proceeding, which, unlike the method suggested by the MM. Boullay, does not impair the quality of the product. You need simply reduce the bark in the first instance to powder, treat this in the way indicated in the recipe, and subsequently subject the grounds to the action of the press.

Wine, from the alcohol and acids which it contains, is a good solvent for the active principles of bark. The solvent properties of the wine are, of course, still further assisted by the alcohol added to it according to the formula.

It has been long observed that bark decolorates wine. M. Henry has found that this decolorizing action of bark is exercised to a much greater extent upon the heavy deep-coloured wines of the south than upon Burgundy wine. He recommends, therefore, to use the latter in preference. I think it would be better still to use a generous white wine. M. Henry attributes the decoloration of the wine to ensuing precipitation of tannin, which, according to him, carries down with it the organic alkalis. This view, however, requires confirmation.

Madeira wine will be found exceedingly well suited for the preparation of wine of bark.

VINOUS SYRUP OF BARK.

Take of Soft extract of bark, 1 part.
Lunel wine (Muscadine), 20 parts.
White sugar, 30 parts.

Dissolve the extract in the wine, filter the solution, and add the sugar to the filtrate; dissolve at a gentle heat in a close vessel.

50 grammes of this syrup contain 1 gramme of extract of bark.

BEER OF BARK.

Take of Pale bark, 1 part.
Good ale, 32 parts.

Let the bark macerate in the ale for two days; strain.

MORPHIA—CODEIA—NARCOTINA.

The three alkaloids, morphia, narcotina, and codeia, which are found in poppy and opium, are the chief, perhaps the only, principles to which the medicinal properties of these precious substances are attributable.

MORPHIA.

This alkali was discovered by Sertuerner in 1816. Its formula is—

$$C_{35}\,H_{20}\,N_1\,O_6.$$

Morphia crystallizes in four-sided pyramids. It has no smell; its taste is bitter. In the crystalline state it contains two equivalents (5.73 per cent.) of water, which it loses at a temperature of 248° Fahr., together with its transparency. At a still higher temperature it fuses into a yellow liquid.

Morphia is insoluble in cold water; it dissolves in 92 parts of boiling water, but recrystallizes from the solution upon cooling.

It is soluble in 40 parts of cold anhydrous, and in 30 parts of boiling common, alcohol. It is very sparingly soluble in ether, but dissolves readily enough in fixed and volatile oils. The solution of morphia reddens turmeric paper, and turns violet paper green.

Morphia is soluble in the caustic alkalis; it is even slightly soluble in ammonia; it dissolves in nitric acid with a blood-red colour.

When projected in powder into a concentrated and only very slightly acid solution of persulphate of iron it strikes a blue tint. M. Pelletier has observed that sulphate of morphia is formed in this reaction, and that the iron, reduced to the state of protoxide, enters into combination with a new acid resulting from the decomposition of part of the morphia; to this new compound he has given the name of morphite of iron.

Morphia decomposes iodic acid in solution, and sets the iodine free. Serullas, who discovered this peculiar action of morphia on iodic acid—(the other vegetable alkalis combine with the iodic acid and form iodates)—recommends the use of iodic acid for the detection of the presence of morphia. For this purpose the suspected liquid is triturated with a little starch jelly, and a few drops of iodic acid, or of a dilute solution of perchloride of iodine, are then added: the appearance of the blue tint which iodine is known to strike into starch will at once reveal the presence of morphia.

Morphia is one of the most powerful alkaline bases.

The salts of morphia are almost all of them crystallizable; they have a bitter taste; most of them are readily soluble in alcohol, and insoluble in ether. Their action on the animal economy is analogous to that of morphia, i. e., sedative and narcotic. They are precipitated from their solutions by the alkaline carbonates; caustic alkalis (and also ammonia) added in excess redissolve the precipitates.

Infusion of gallnuts precipitates the salt of morphine. Iodic acid is decomposed by the salts of morphia in the same way as it is by the alkalis. The salts of morphia strike a blue tint with solutions of the neutral persalts of iron.

Perchloride of gold precipitates the salts of morphia with a yellow colour, which subsequently changes to blue. Nitrate of silver is gradually reduced by the salts of morphia, and imparts to them a blackish-grey tint.

CODEIA.

This alkali was discovered in 1833 by M. Robiquet.

Its formula is:—

$$C_{35}\,H_{20}\,N_1\,O_5.$$

It differs from morphia simply in this, that it contains one equivalent of oxygen less than the latter alkali.

Codeia crystallized from ethereal solution is anhydrous; crystallized from aqueous solution, it retains two equivalents of water = 5.8 per cent.

Codeia crystallizes in straight rhomboidal prisms.

It loses its crystallization water at a high

temperature; at 302° Fahrenheit it fuses without decomposition or volatilization.

Codeia is soluble in water. 100 parts of water at 60° Fahrenheit dissolve 1.26 of the alkali; water at 110° F. dissolves 3.7 per cent., at 212° F. 5.9 per cent. When more of the alkali is present than the boiling water can dissolve, the undissolved portion fuses, and forms a species of oily stratum at the bottom of the vessel. Codeia is soluble in alcohol; it dissolves more readily and largely in hot than in cold alcohol. It dissolves also very readily in ether. It differs from morphia by its solubility in ether, and insolubility in caustic alkalis, and, moreover, in the following points:—It decomposes neither iodic acid nor the persalts of iron, and is not coloured red by nitric acid.

Codeia saturates acids. Its saturation capacity is nearly the same as that of morphia. The salts of codeia differ from those of morphia in this, that the precipitate formed in their solutions by the addition of alkaline carbonates is not redissolved upon addition of alkali in excess, as is the case with the salts of morphia; and also in this, that the salts of codeia exercise no action upon persalts of iron and upon iodic acid.

Royal Society.—The Earl of Rosse held his fourth soirée on Saturday, the 16th. Amongst several novelties in the rooms we observed some beautiful specimens of flax prepared by a new process invented by the Conte de Changy. From the coarsest and dirtiest flax he obtains by chemical treatment a fibre equalling the finest silk. Mr. Sharp, of Dublin, exhibited an ingenious register clock. Mr. Rennie an adaptation of the motion of a fish's tail to impel a vessel worked by steam. Mr. Brooke exhibited his self-registering thermometric apparatus, which has recently been introduced at the Royal Observatory. The soirée was largely attended.

Royal College of Surgeons.—The following gentlemen, having undergone the necessary examinations for the diploma, were admitted members of the college at the meeting of the Court of Examiners on the 22d inst.:—Messrs. Robert Coker Nash Davies, Worcester; Edward Buckell, Chichester; Charles Alworthy, Newtownards, county of Down; Dudley Clifton Wodsworth, Cambridge-street, Hyde-park; Charles Hall Chambers, Lifford, Donegal; Thomas Francis, Welchpool, Montgomeryshire; Walter Robert Crouch, Burton, Somerset; Frederick William Napoleon Wilson, Newcastle-upon-Tyne; Harvey Ludlow, London; Henry Christian Hare, Marlborough-villas, St. John's-wood; and William Francis Noot, Portsmouth. At the same meeting of the court Messrs. Joseph Coulter, Frederick William Blake, and John Colmer Austin passed their examinations for naval surgeons. These gentlemen had previously been admitted members of the college, their diplomas bearing date respectively, February 23, 1844; April 14, and 21, 1845.

New Cure for Cholera.—A correspondent of the *National*, resident at Muret, communicates to his friend, the editor of that paper, the following cure for cholera morbus:—"Father Joseph Rizzolatti, Vicar Apostolic of Hou-Kouang, wrote on the 25th of November, 1842, to the General of the Franciscans of Alexandria, a letter filled with details of the manners and customs of the Chinese, in which the following passage occurs:—'Among other attacks on my health, I have had the cholera morbus, and I should have been a dead man in twenty-four hours had not the malady been taken in time by a good physician. The ordinary and most convenient treatment in this:—The tongue of the patient is punctured in innumerable places with the point of a table-knife, or a crystal blade, so as to provoke an abundant effusion of blood. Then, whilst some of the attendants stretch the principal nerves by main force, others give the patient severe blows on the chest, the back, the thighs, and the hips until torrents of blood gush forth. When the crisis is over the patient recovers, at the cost of numerous scars and bruises, and a skin as black as that of a negro.'"

CHEMICAL TABLES, ARRANGED FOR THE CHEMICAL TIMES,

By GEORGE CALEY, Esquire, 2, Mortimer-terrace, Notting-hill, Kensington.

TABLE SHOWING THE BLOWPIPE REACTIONS OF THE METALLIC OXIDES AND METALLIC ACIDS.

DIVISION OF METALLIC OXIDES ACCORDING TO THEIR DEPORTMENT, WHEN HEATED WITH CARBONATE OF SODA ON A CHARCOAL SUPPORT, IN THE REDUCING FLAME, WITH THEIR COMPORTMENT WITH BORAX, MICROCOSMIC SALT, SOLUTION OF NITRATE OF COBALT, &c.

A.—OXIDES REDUCED WHEN HEATED WITH CARBONATE OF SODA ON CHARCOAL.[1]

1.—*Those which furnish a Sublimate* [2] *on the Charcoal Support, without residue of Metal, in which case the Metal is wholly Volatilized.*

	Fused on Platinum Wire with Borax and Microcosmic Salt.	Remarks.
Oxide of Zinc (yellow incrustation while hot, becoming white on cooling).	- - A colourless glass in the oxidizing flame when cold, with reduction in the deoxidizing flame.	- - When oxide of zinc is moistened with a solution of nitrate of cobalt, and heated on charcoal, it becomes green on cooling. Oxide of tin assumes a bluish-green colour when similarly treated with solution of cobalt.
Oxide of Cadmium (reddish-yellow incrustation).	- - Colourless while hot, white on cooling.	- - The characteristic reaction of oxide of cadmium is its depositing a dark yellow or red incrustation on charcoal. In thin layers it is of a pale yellow colour.
Tellurous Acid (white incrustation, with a reddish border, the flame appearing of a greenish colour).	- - Colourless glass in the oxidizing and grey in the reducing flame.	- - It fuses when heated in a glass tube, forming colourless drops;[3] after which it completely volatilizes in white fumes. When heated with carbonate of soda on platinum wire it yields a fusible bead. Tellurous acid is much more difficultly volatilizable than oxide of antimony.

Arsenious Acid.—Heated on charcoal with carbonate of soda, a white sublimate settles on the charcoal at a considerable distance from the assay; at the same time a strong odour of garlic, occasioned by the reoxidation of the reduced metal, is produced. When arsenical compounds are roasted in a tube open at both ends copious white fumes of arsenious acid are evolved.—(*See further Arsenites and Arseniates.*)

2.—*Oxides which furnish both a Sublimate and a residue of Metal.*

Lead (sulphur-yellow incrustation on cooling, with a ductile globule of metallic lead).	- - Dissolves to a clear yellow glass, which after cooling is colourless.	- - Oxide of lead is darker when hot, and resumes its pale yellow colour on cooling. Red lead heated slightly on charcoal becomes black. Heated with soda on platinum wire, oxide of lead fuses, and leaves an opaque yellow glass on cooling.
Bismuth (reddish-brown incrustation, with a white brittle globule of bismuth).	- - Yellow while hot, and colourless after cooling, in both flames.	- - Metallic bismuth is readily distinguished from lead by its breaking in pieces when struck with the hammer. The oxide when heated in a glass tube fuses into yellow drops.
Antimony (white incrustation, with a brittle globule).	- - Yellow glass while hot, colourless when cold, in the oxidizing, and grey in the reducing, flame.	- - Both antimony and bismuth yield brittle metals, but the copious white fumes which cover the charcoal readily distinguish the former from the latter. Dense white fumes are evolved when antimonial compounds are heated in an open glass tube.

3.—*Oxides which furnish a Metallic Residue, but without Incrustation.*

Copper (red spangles of metal).	- - In the oxidizing flame the glass is green while hot and blue when cold: in the reducing flame it is red after cooling. A small portion of tin, when fused with the green glass, instantly reduces it to red suboxide.	- - When the reduced copper is heated in the oxidizing flame it acquires a coating of black oxide. Moistened with most acids, and heated before the blowpipe, the flame is green; but when hydrochloric acid is used a blue colour is given. The brown borax glass is reconverted to blue on fusion with a little nitre.
Gold (yellow).....	- - Insoluble both in borax and microcosmic salt. The metal fuses to a globule.	- - Heated on charcoal, the soda is absorbed, and the metal fuses to a globule.
Silver (white ductile metal).	- - The glass is white in the oxidizing and grey in the reducing flame after cooling. In the oxidizing flame with phosphorus salt the glass is yellowish: it appears red by candle-light.	- - The globule of silver is known from antimony and bismuth by its being malleable, from lead by giving no yellow incrustation, and from tin by its not reducing to red the blue borax lead of copper. The compounds of silver are rapidly reduced on charcoal with soda.
Tin (ductile metal).	- - Colourless or opaque glass in the oxidizing, and partly reduced with borax in the reducing, flame, when operating on a large quantity of tin.	- - The oxides of tin are very easily reduced on charcoal with carbonate of soda, giving a soft, ductile metal, without incrustation, or, at least, with a very slight one. The globule is easily distinguished from antimony and bismuth by its malleability, from silver by its instantly reducing to red a green bead of oxide of copper, and from lead by its yielding no yellow sublimate on charcoal. Moistened with a solution of nitrate of cobalt and heated, oxide of tin presents a bluish-green appearance.

DIVISION OF METALLIC OXIDES.—(*Continued.*)

	Fused on Platinum Wire with Borax and Microcosmic Salt.	REMARKS.
NICKEL (white particles).	- - In the oxidizing flame the borax glass is violet while hot and red after cooling. With phosphorus salt it is red while hot and colourless when cold. In borax glass grey in the reducing flame.	- - The white particles of nickel obtained on charcoal with carbonate of soda are magnetic.

MERCURY (white liquid metal).—When mercurial compounds are mixed with carbonate of soda and heated on charcoal before the blowpipe they are readily reduced; but the metal is so volatile that it is instantly dissipated at an elevated temperature. In proceeding, therefore, to examine for mercury, the following method is commonly adopted:—The substance is, in the first place, mixed with carbonate of soda or black flux; the mixture is then introduced into a narrow tube closed at one end, and heated to redness over a spirit-lamp. By this operation the metal accumulates in the upper portion of the tube as a grey sublimate, which rubbed with a glass rod coheres, and runs in fluid globules, a property peculiarly characteristic of this metal. If a piece of gold leaf be exposed to the mercurial vapour during the sublimation it becomes white, even when the mercury present was very small in quantity.

IRON (grey).	- - Yellow or red while hot, becoming yellow or colourless on oooling, according to the quantity of iron used. In the reducing flame, especially with a small quantity of tin, the glass becomes bottle-green.	- - Compounds of iron are reduced on charcoal with soda, leaving a grey metallic powder, which is magnetic. The characteristic blowpipe reaction for iron is its behaviour with borax and microcosmic salt. Chromium also gives a green glass, which differs from that afforded by iron by its retaining its green colour in both flames.
COBALT (grey).....	- - A deep blue glass in both flames, whether hot or cold. Cobalt masks the iron reactions. When mixed with iron the blue colour persists in the reducing, and becomes green in the oxidizing, flame after cooling.	- - When oxide of cobalt is heated on platinum wire a red transparent mass is procured, which is grey after cooling. The metal is magnetic.
MOLYBDIC ACID (grey powder).	- - In the oxidizing flame the beads of borax and microcosmic salt are yellow when hot, and colourless after cooling. In the reducing flame, with borax it is brown, with microcosmic salt green. The latter change is promoted by the addition of a particle of tin to the fused bead.	- - Molybdic acid melts and is absorbed by the charcoal when heated alone on charcoal in the oxidizing flame; it yields a metallic powder in the reducing flame. It fuses with effervescence when heated with carbonate of soda on a platinum wire, yielding a glass which is clear while hot, but turns opaque on cooling.
TUNGSTIC ACID (metallic gray powder).	- - With borax colourless or yellow in the oxidizing and yellow in the reducing flame. With microcosmic salt it is yellow in the outer flame, but blue in the reducing flame. The blue glass becomes red on addition of iron.	- - Tungstic acid blackens and remains infusible when heated alone on charcoal. Fused with carbonate of soda on platinum wire, it gives a yellow glass. A plate of zinc produces a blue solution of oxide of tungsten when introduced into an acid solution of an alkaline tungstate. Tungstic acid differs from titanic by the solubility of its alkaline compounds, and the separation of its yellow hydrated acid, insoluble in water, therefrom.
OXIDES OF PLATINUM, PALLADIUM, RHODIUM, IRIDIUM.	- - Not dissolved either in borax or microcosmic salt. The reduced metals subside, but form no globules.	- - These metals are easily reduced, with or without the addition of carbonate of soda.
VANADIC ACID.	- - With borax and microcosmic salt, a yellow glass in the oxidizing flame. Brown when hot, and green after cooling in the reducing flame.	- - Vanadic acid is partly reduced when heated with carbonate of soda on charcoal. Heated alone, it is partly absorbed by the charcoal. On platinum wire with soda it dissolves.

B.—METALLIC OXIDES WHICH ARE NOT REDUCED TO THE METALLIC STATE WHEN HEATED ON CHARCOAL WITH CARBONATE OF SODA IN THE REDUCING FLAME.

1.—*Metals Proper.*

OXIDES OF MANGANESE.	- - Both borax and microcosmic salt give an amethyst-coloured glass in the oxidizing flame, which is promoted by the addition of a little nitre to the bead. Used in larger quantities, the bead is black. After long heating in the reducing flame it becomes colourless.	- - When manganese compounds are heated on a piece of platinum foil with carbonate of soda, a green mass of manganate of the soda is obtained. This change is the more readily effected when a little nitre is added to the mixture. Oxides of manganese are not reduced on charcoal with reducing agents.
CHROMIUM	- - Dissolves both in borax and microcosmic salt, forming an emerald-green glass on cooling, both in the oxidizing and reducing flames. It suffers no change, like the green glass of oxide of copper, when heated in the reducing flame.	- - Compounds of chromium are not reduced when heated on charcoal with soda. Fused on platinum foil with carbonate of soda, especially when a little nitre is added, they produce a yellow mass of chromate of potash, soluble in water; the solution giving a red precipitate with nitrate of silver.
TANTAILC ACID ...	- - Both in the borax and microcosmic beads a colourless glass, which becomes opaque on cooling. Same in the reducing flame.	- - Heated on platinum wire with soda, effervescence takes place, but it is neither reduced nor fused. Its acid solutions are changed to blue by a sheet of zinc. On standing the blue solution becomes brown.

[For the conclusion of the Division of Metallic Oxides, see page 29.]

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON DEVITRIFICATION.

By D. C. SPLITGERBER.

The author shows, in accordance with Fournet's statements, that there is a crystalline and an amorphous devitrification, both of which are produced by the decomposition of the constituents of the glass into different new opaque compounds, of which we have analogous examples in obsidian and the slags.

Devitrification is produced under various circumstances; for instance, when the glass is very frequently heated and cooled in the furnace, especially when it contains much lime and alumina; it loses its conchoidal fracture and its transparency; its vitreous lustre is converted into a waxy lustre; and finally the mass becomes quite porcellaneous. This change proceeds from the surface to the interior.

A slight loss of alkali, which is volatile at a high temperature, cannot be avoided in this operation; but this is not the cause of the opacity, as the loss of alkali is never very considerable, and as transparent glass can be made with a still less amount of alkali, and moreover the devitrified mass can be remelted into good glass without any further addition. The cause must rather be sought for in a resolution of the original composition of the glass into other opaque compounds in the softened mass.

A very remarkable case of devitrification was obtained by allowing a crucible containing soda glass to cool very slowly; a devitrified crust, 6 to 7 millimetres in thickness, had formed on the surface of the good glass, whilst a crucible with potash glass close to it had remained quite unaltered. This crust, which is accurately separated from the transparent glass, and appears at first sight quite amorphous, contains in the uppermost opaque portion, on careful examination, a tissue of minute crystals, which are difficult to detect in the nearly opaque mass, whilst the lower portion presents not a trace of crystallization; we have here then a crystalline and an amorphous devitrification together, in which most probably the small crystals were last formed in the opaque mass.

Notwithstanding the great physical difference of the glass and the crust externally, their specific gravity is very close; the specific gravity of the crust was 2.503, whilst that of the subjacent glass was 2.485. This difference was found to be quite constant in several weighings. We have here something similar to what happens in vesuvian and garnet, which in the crystalline state exhibit a greater density than after fusion, which renders them amorphous and vitreous.

No differences worth mentioning were found in the analyses of the two masses; they are both sexsilicates:—

The Glass.			
75.73	SiO_3	containing	39.35 O
13.18	NaO	"	3.40 O
9.58	CaO	"	2.73 O
1.51	Al_2O_3	"	0.70 O
The Crust.			
76.27	SiO_3	containing	39.63 O
13 06	NaO	"	3.37 O
9.32	CaO	"	2.66 O
1.35	Al_2O_3	"	0.63 O

On another occasion, when the cooling had been effected more rapidly, some opaque white granules had formed in the vitreous mass, around which regular phenomena of polarization were exhibited, showing the tension caused in the glass. It may be assumed that the above-described crust had originated from an agglomeration of similar granules, which in the slow cooling had time to form.

On another occasion some similar granules had formed at the bottom of the melting-furnace in impure potash glass, or rather in some glass slag. This distinctly showed a tendency to a regular formation of crystals, but which had

been prevented by the tenacity of the mass, they being frequently six-sided prisms, but without sharp edges and surfaces. On analysis it exhibited considerable resemblance to the crystallized glass analyzed by Dumas. It furnished:—

Silica.....	69.34	containing	36.00 oxygen.
Potash	13.94	"	2.36 "
Lime.....	11.31	"	3.21 "
Alumina ..	5.41	"	2.52 "

In the plombiferous glass slag in the collection of Prof. H. Rose, and which was presented to him by Prof. Faraday, the author observed some perfectly similar six-sided crystals, but which were much sharper and more developed, probably from the mass being more readily fusible, than the above.

Devitrification was moreover met with in various glass mixtures containing lime when the firing had been continued for several hours; acicular crystals separated, but which again dissolved and disappeared at a higher temperature. The potash glass bore a much larger addition of lime than the soda glass.

The author then describes some experiments on the volatilization of the alkali. They show that its quantity is dependent on various concomitant causes, and increases when the temperature is continued for a long time, and especially with a greater addition of lime. It was also found that soda is far more ready volatilized in the furnace than potash.—*Berlin Berichte.*

ON THE ESTIMATION OF ARSENIC.
By HENRY ROSE.

The best method of separating arsenic acid from its solutions, when its quantity has to be determined, is decidedly that which Levol proposed, that of precipitating it in the form of arseniate of ammonia and magnesia. Levol recommends calcining the dried precipitate, in order to convert it into $2MgO, AsO_5$, from which compound the amount of arsenic acid can be calculated. But this furnishes an erroneous result, for the arsenic acid is reduced at a high temperature by the ammonia, and a loss results, which becomes greater the longer the ignition is continued. The weight of the precipitate should be determined either by drying it over sulphuric acid, or, better still, *in vacuo*, or by exposing it to a temperature of 212° F., until it no longer decreases in weight. In the first case, the precipitate has the composition $2MgO+NH_4O+AsO_5+12HO$; in the latter case, $2MgO+NH_4O+AsO_5+HO$.

When the arsenic is contained in solution in the state of arsenious acid, it must first be converted into arsenic acid, in order to determine it as arseniate of ammonia and magnesia. This is best effected by means of chlorate of potash and hydrochloric acid, taking care to avoid a strong or long-continued heat, as otherwise some arsenic might be volatilized in the form of chloride.

Even when arsenic is precipitated from a solution by sulphuretted hydrogen, its amount is best ascertained by converting the sulphuret, without previously determining its weight, by means of chlorate of potash and hydrochloric acid, into arsenic acid, and then precipitating this as arseniate of ammonia and magnesia. When arsenic is contained in a solution in the state of arsenious acid, its amount can be very accurately ascertained by means of a solution of chloride of gold. From the amount of gold reduced the quantity of the arsenious acid can be calculated.

In most of the salts of arsenic acid which are insoluble in water, the bases can be separated from the acid by fusion with carbonated alkali. This even succeeds with those arseniates the corresponding phosphates to which cannot be perfectly decomposed in this manner, for instance with arseniate of lime. However, this mode of decomposition is not easily executed, on account of the nature of the vessels which we are compelled to employ; for platinum crucibles are too much acted upon by the operation, and in using porcelain crucibles silica is dissolved.

The method employed to separate phosphoric acid from strong bases that by means of metallic mercury and nitric acid, may also be employed to effect the separation of arsenic acid from the same bases. But it is not possible to determine the amount of arsenic in the separated arseniate of the protoxide of mercury, as it cannot be fused with carbonated alkali without violently acting upon the vessels.

The separation of arsenic from tin is best effected by converting the metals into sulphurets, and heating them in an atmosphere of sulphuretted hydrogen, when the sulphuret of arsenic is volatilized, and its vapours can be passed into solution of ammonia, whilst the sulphuret of tin is left behind. Long after experiments on this subject had been made, the author found that Ebelmen had recently proposed a similar method for their separation.

The separation of arsenic from antimony can be effected according to two methods. The first method is essentially similar to that which the author proposed some time back to separate tin from antimony. The oxidized compound is fused with hydrate of soda, and the mass, after disintegration in water, treated with dilute alcohol, with which the antimoniate of soda is also washed, it being insoluble in it. The second method can be used, especially when the two metals are contained as acids in a solution. Tartaric acid and chloride of ammonium are added to the solution, and the arsenic acid then precipitated as arseniate of ammonia and magnesia; the antimonic acid remains in solution, from which it can be precipitated, after being acidified by hydrochloric acid, as sulphuret of antimony. This method can also be employed to distinguish a mirror of antimony from one of arsenic, when they have been obtained by Marsh's method.

With respect to the separation of arsenious from arsenic acid, Levol has proposed to separate the arsenic acid, as arseniate of ammonia and magnesia. The amount of the arsenious acid, however, can be very readily ascertained by means of perchloride of gold.—*Berlin Berichte*, 1849.

ON THE ESTIMATION OF THE SUGAR OF MILK, AND DETERMINATION OF THE RICHNESS OF MILK.
By Professor POGGIALE.

As none of the processes hitherto known furnish a quick and accurate indication of the richness of milk, I imagined that if we could determine without the balance, by the method of volumes, one of its constituent elements, the problem would be solved. I believe I have succeeded in attaining this result by ascertaining the proportion of the sugar of milk. Several samples of pure milk have been submitted to chemical analysis.

The following is the mean of ten analyses:—

Water	862.8
Butter	43.8
Sugar of milk	52.7
Caseine.....	38.0
Salts	2.7
	1000.0

Thus, according to my experiment, 1,000 grms. of milk contain 52.7 grms. of sugar M. Boussingault found, in a series of observations, a mean of 50 grms., a difference which is undoubtedly owing to the processes followed for its determination. The quantity of sugar contained in milk is considerable, and, moreover, presents but slight variations. The process which I propose is the application of that of M. Barreswil to the estimation of the sugar of milk, which, like glucose, reduces the salts of copper; and the proportion of salt of copper decomposed will afford the amount of sugar of milk.

Preparation of the Test Liquor.—This is prepared by adding to a solution of sulphate of copper bitartrate of potash, and dissolving the precipitate which is formed in caustic potash. The strength of the alkaline solution is then determined with great care, from the quantity of sugar employed to decolorize a known volume of the liquid. It is important to observe that milk-sugar, and not cane-sugar, must be employed in this operation. I made several experiments in order to avoid the determination of the strength of the solution of binoxide of copper, which is decidedly the longest and most delicate experiment. The following proportions constantly furnished a liquid, 20 cubic centimetres of which correspond to 0.200, or 2 decigrammes, of whey:—

Crystallized sulphate of copper	10 grammes.
Crystallized bitartrate of potash ..	10 "
Caustic potash	30 "
Distilled water	200 "

The filtered liquid is perfectly clear, and of an intense blue colour.

Preparation of the Whey.—To determine the amount of sugar of milk, it is indispensable to separate the fatty matter and the cascine by coagulation. This is easily effected by placing 50 or 60 grms. of the milk in a small flask, adding to it a few drops of acetic acid, and then raising the temperature to between 104° and 122°. A transparent liquid is obtained on filtration. According to my experiments, 1,000 grms. of milk yield 923 grms. of whey, which gives for 1,000 grms. of whey about 57 grms. of sugar.

Examination of the Whey.—20 cubic centimetres of the test-liquor are introduced by means of a pipette into a small flask, which should be preferred to a porcelain capsule, as it allows of the liquid being seen from top to bottom, and of observing with the greatest ease the moment the decolorization is complete. The liquid is then boiled. On the other hand, a burette, each division of which is equal to a fifth of a cubic centimetre, is filled with the whey, and this poured drop by drop into the liquid, agitating the latter continually, and heating it after each addition of whey. This is continued until the blue tint has entirely disappeared. At first a yellow precipitate of hydrated protoxide of copper is formed, which, however, soon turns red and sinks to the bottom of the flask. When the operation is terminated the quantity of whey employed is read off the burette, and the weight of sugar contained in 1,000 grms. of whey determined by rule of three.

I admitted above that 1,000 grms. of whey contain 57 grms. of sugar; we must, however, not be particular about a few grammes more or less. The most usual adulteration, the addition of water, is easily detected by estimating the sugar. It is, however, possible that the cream might be removed without any addition of water, or with the addition of cane-sugar or sugar of milk. In this case I determine by a simple and quick process the quantity of fatty matter by adding acetic acid to the milk, boiling, and agitating it after cooling with ether, which removes the butter. The ethereal solution is decanted and evaporated. It is frequently advisable to repeat the examination of the whey, which, as all the arrangements are made and the strength is nearly known, does not occupy more than one or two minutes.—*Comptes Rendus* and *Chemical Gazette.*

Mr. Horsley, of Ryde, proposes to purify water, and deprive it of hardness, by combining chemical and mechanical means. Some experiments have been publicly tried with great apparent success, but we have yet to learn the applicability of the process and its ceremony. The subject to a great maritime country like our own is too important to be neglected if the plan is available within moderate cost.

An exhibition took place the other day, at Messrs. Robinson's factory, Pimlico, of an electro-magnetic engine invented by Mr. Hjorth. The engine works horizontally, making a stroke of thirteen inches. Some progress has certainly been made in this application of science, but much remains to be accomplished.

DIVISION OF METALLIC OXIDES.—*(Continued.)*

	Fused on Platinum Wire with Borax and Microcosmic Salt.	REMARKS.
TITANIC ACID.....	- - In the oxidizing flame the glasses of borax and microcosmic salt are colourless or yellow while hot, and opaque on cooling. In the reducing flame, yellow or red while hot, becoming violet when cold. The latter change is promoted by addition of a small portion of tin to the bead. The presence of iron causes the glass to assume a brown colour when cold.	- - When titanic acid is heated on platinum wire with carbonate of soda effervescence takes place, and a yellow glass, which becomes opaque on cooling, is produced. It is neither reduced nor is the soda glass absorbed when heated on charcoal. Acid solutions of titaniates are changed to blue on introducing a sheet of zinc, tin, or iron.
URANIC ACID.....	- - In borax and microcosmic salt, yellow in the oxidizing and green in the reducing flame. Blackens by an intermitted reducing flame.	- - Uranic acid blackens without fusion when heated alone on charcoal. It is insoluble in carbonate of soda when heated on the platinum wire.
OXIDE OF CERIUM.	- - Red or yellow while hot, and colourless or slightly yellow with borax, in oxidizing flame, and colourless in the reducing flame. With microcosmic salt, colourless in the oxidizing and reducing flames after cooling.	- - Oxide of cerium when heated alone becomes converted to the peroxide. With carbonate of soda on charcoal, protoxide remains of a light grey colour. It does not dissolve in carbonate of soda on platinum wire.

2.—*Earths Proper.*

ALUMINA	- - It dissolves as a colourless glass, which, however, becomes opaque after cooling on the addition of an excess.	- - Alumina is not changed when heated on charcoal alone, or with carbonate of soda. Moistened with a solution of nitrate of cobalt, and heated on charcoal before the blowpipe, it leaves, on cooling, a sky-blue mass.

GLUCINA, YTTRIA, ZIRCONIA (gives a strong light on charcoal), THORINA.—These earths are best known by their remaining as an infusible white mass when ignited either with or without carbonate of soda on charcoal. In their behaviour with beads of borax and microcosmic salt they all resemble alumina, but they differ from it remarkably by producing a dark grey colour with a solution of nitrate of cobalt.—(*See Alumina.*)

3.—*Alkaline Earths and Alkalis.*

BARYTA	- - Fusible barytic salts impart a greenish-yellow colour to the exterior flame when fused on platinum wire.	- - The alkaline earths when heated on charcoal become an infusible mass, which changes to blue a piece of reddened litmus paper previously moistened. Heated strongly with carbonate of soda on charcoal, for some time, both strontia and baryta are absorbed, but lime and magnesia are not acted upon.
STRONTIA.....	- - Salts of strontia heated on platinum wire communicate a crimson colour to the blowpipe flame.	
LIME (strong light on charcoal).	- - Salts of lime give a reddish colour to the flame.	
MAGNESIA	- - When moistened with a solution of nitrate of cobalt it presents a flesh-coloured appearance after heating.	
POTASH	- - Gives a violet colour to the outer flame, which is destroyed by the presence of soda. It changes to blue a brown glass of borax and oxide of nickel. (4)	- - The alkalis are known by their reaction on reddened litmus or turmeric paper, and by their being immediately absorbed when heated on charcoal.
SODA	- - Characteristic yellow colour.	AMMONIA is known by its peculiar odour in conjunction with its alkaline reactions to red litmus paper. (5)
LITHIA	- - The exterior flame is intensely crimson. It gives a transparent glass when fused on platinum foil with phosphate and carbonate of soda.	

NOTES.

(1) A much more powerful reducing effect is obtained by using a mixture composed of three parts of carbonate of soda and one of cyanide of potassium. The manner of proceeding is to knead the mixture with the powdered substance in the palm of the hand with a little water. The mass is then placed in a small cavity made in the charcoal, and the reducing flame directed upon it for some time. After the whole has become cold it is cut out and powdered in a mortar. On the addition of water the soluble reducing agents dissolve, the charcoal floats on the surface, and the metallic particles, or, in particular cases, metallic globules, subside, and are easily recognised.

(2) Salts of ammonia might inadvertently be mistaken for white sublimated oxides when mixed with carbonate of soda; however, a powerful odour of ammonia is recognised. This reaction immediately distinguishes ammonia from all other substances.

(3) Osmic acid likewise forms colourless drops when similarly treated, at the same time evolving an odour resembling that of chloride of sulphur.

(4) The glass of borax and nickel is obtained by fusing a bead of borax with oxide of nickel till it remains brown after cooling; the potash is added and fused into the globule, which is changed to blue.

(5) For a description of the various blowpipe operations see pages 107 and 121, vol. iv., of the *Chemical Times*.

ON THE WELDING AND WORKING OF METALS.

By M. J. FOURNET.

It is commonly supposed that iron and platinum are the only metals which possess the property of welding together without previous melting; yet, when it is seen that two plates of lead, highly polished, acquire merely by pressure such an adherence to each other that, notwithstanding the imperfection of the contact, a weight of many pounds is necessary to effect their separation, and that after the separation the surfaces present actually a broken aspect, it must be admitted that lead ought to be ranked in the number of weldable metals. There is, however, this difference attending it, that, instead of requiring a higher or lower temperature, it possesses, under ordinary circumstances, sufficient softness for welding.

The latter consideration has suggested the possibility of treating various metallic powders in such a manner as to bring them to a state of agglomeration, ductility, and cohesion, without passing through the intermediate process of fusion. I will, nevertheless, except from the number those metals that are brittle, and not malleable; for the stroke of the hammer and pressure would destroy, instead of increasing, the cohesion. Yet it is possible that circumstances may exist favourable to the cohesion of some of them, since zinc, for example, can easily be drawn into fine wire at a temperature near the point of boiling water; and I once accidentally obtained very pure and ductile bismuth by a kind of solution whilst effecting the partial sulphuration of a mass of that metal. It was evident that, in these operations, it was necessary to avoid the interposition of any substance different from that of the metal to be welded, because the presence of any such substance would prevent the approximation of its particles; consequently, it is also necessary to avoid the formation of oxides in the operation, which would produce the same effect as foreign matters. Iron, for example, can be welded, because it is capable of bearing a strong white heat without melting; the heat fuses the oxidized particles which the strokes of the hammer expel from the surfaces that come in contact. It is also from the contrary cause that the fracture of the same iron, when broken with a hammer, and preserving part of its oxide in the interior of its pores, presents nothing but a number of unconnected fibres, and in the interstices a grey dust is perceptible, which is merely the interposed oxide, the existence of which prevents the entire cohesion.

This being admitted, I first operated on pulverized silver, reduced from the chloride by sulphuric acid and zinc. This powder, placed in a crucible, was submitted to a simple annealing, which caused the particles to approach sufficiently close to enable them to bear slight strokes of the hammer without separating. This first precaution taken, I heated it again; then I submitted the mass to another hammering, and continued to repeat this till, after a succession of operations, I obtained a bar perfectly cohesive, ductile, and homogeneous, which I hammered into plates, and of which I formed a vase, the high polish of which was a proof of its entire homogeneousness. This process is exactly similar to the one which has been adopted with platinum.

I afterwards tried gold obtained in powder by precipitation from solution in aqua regia. The results were exactly the same as with silver.

I saw that a similar effect ought to be produced on copper if I could succeed in preventing the formation of oxide; and I attempted the experiment on the metallic powder produced by the reduction of peroxide by a current of hydrogen gas. Yet I experienced great difficulties on account of the facility with which films of oxide were formed even while operating under charcoal. The following is the method which has succeeded best:—I put into the tube used for the

operation a scarcely cohesive lump the size of a walnut; I impregnated it with oil, and heated it rapidly to redness. Then I hammered it with the greatest precaution. I again impregnated it with oil, and continued to do so till at length there remained, after considerable waste, a small bar of ductile red copper, which I could afterwards form into plates in the same manner as gold and silver. It is evident that oxide of nickel, which is reduced by the least contact with carbonated vapours, and which the flame of the blowpipe instantly changes into a metallic powder, even when covered with borax, could be acted on in the same manner as the preceding metals; and that it would also be possible to obtain specks of this metal, which has hitherto been considered so refractory.

However this may be, my successful attempts on gold and silver suggested the possibility of obtaining a damask from these two metals, which it is impossible to produce by fusion.

To effect this I placed in a crucible alternate layers of silver and gold dust, and the operation answered my expectations, in adopting the same process which I had followed with the metals separately; but the imperfect method I have described is naturally capable of great improvements. It would be possible, for instance, by the aid of the hydraulic-press, to form a plate of silver powder sufficiently cohesive to support itself. This plate should be stamped by a punch, and the spaces filled with gold dust, also agglomerated. From this would result a kind of plating, which might be rendered more cohesive by annealing, and afterwards by hammering, till the mass had acquired density and metallic cohesion.

It will be conceived that in this preparation it would be very essential to take into account the contractility of the metals, otherwise there would be continual separation of parts, and consequently fractures. Yet there is no occasion to be discouraged by any slight gaps that may be perceptible after the operation is ended, for I have learnt from experience that they disappear on the application of the hammer, and on the approximation of the particles.

It would be possible to obtain characters, devices, marblings—in short, any designs whatever—of gold, inlaid or damasked, in a plate of silver. It would also be possible to put a plate of gold or silver, and by this means immediately manufacture a gilding as thick as required, and more solid than silver gilt. on the simple plate.

The damascene would also be capable of being varied, by polishing either the gold or silver surface, or by merely deadening the silver by aquafortis; or the gold, by rubbing the surface with mercury, which should afterwards be expelled by heat. The workmanship might be still further modified, and colours even produced by annealing the silver surface. This operation has succeeded very well, by covering the surface of a sheet of silver with hydrosulphate of ammonia, and by exposing the whole in a muffle at the degree of heat just necessary to effect the combination of the sulphur and silver: it must afterwards be withdrawn from the fire; otherwise the unequal dilations of the sulphur and metal would cause it to scale off, which is perceived by the decrepitation of the sulphur. The work sulphurized in this manner is at first tarnished and black; but the ductility of the sulphate of silver afterwards approximates the particles sufficiently to display its metallic brightness and its blue steel colour.

The hammering must not be carried too far, otherwise the parts of gold and silver which are joined separate, and form an intermediate rim, more or less large, the shade of which is far from desirable; notwithstanding, by taking the requisite precautions, that property which the two metals possess of being united without fusion may be turned to advantage; for, on afterwards dipping the damascene plates into diluted aquafortis, a series of bands or unpolished marbling is obtained, resulting from the pure silver; then a second series of white or pale yellow veins, which, rendered firm by the mixture of gold and silver, remain polished; and, in short, in the centre there are yellow brilliant bands, which are of pure gold.—*Comptes Rendus.*

ON SOME COMPOUNDS BELONGING TO THE QUINONE SERIES.

By Professor F. WÖHLER.

It had hitherto remained doubtful whether the atomic weight of quinone should be represented by $C^{24}\ H^8\ O^8$ or $C^{12}\ H^4\ O^4$. The author now shows that the latter is most probably the correct one, as it agrees with the found composition of all the compounds belonging to the quinone series. This is the case with the sulphur compounds prepared and previously described by the author, the composition of which has been corrected according to the following formulæ, founded upon new analyses. In connection with these corrections, the author describes some new and highly remarkable sulphur compounds of hydroquinone.

Brown Sulphohydroquinone, $C^{12}H^5O^4S^2$.—This substance, as is well known, is produced by passing sulphuretted hydrogen into a solution of quinone, with the precaution that a little of the latter is left unaltered. It has now been ascertained that its formation is accompanied and caused by the simultaneous production of green hydroquinone, which, on account of its sparing solubility, is precipitated at the same time, and is mixed in variable quantity with the sulphur compound, the colour of which it causes to vary between blackish-brown and reddish-brown. This admixture, which had formerly escaped observation, is the reason why the former analysis gave the amount of carbon too high and that of the sulphur too low. Two equivs. quinone and 2 equivs. sulphuretted hydrogen produce 1 equiv. sulphohydroquinone, $C^{12}\ H^5\ O^4\ S^2$, and 1 equiv. green hydroquinone, $C^{12}\ H^5\ O^4$.

Yellow Sulphohydroquinone, $C^{12}\ H^6\ O^4\ S$, is produced when the preceding substance is suspended in water and submitted to the further action of sulphuretted hydrogen. It is best obtained by saturating a solution of quinone in alcohol with sulphuretted hydrogen, when sulphur separates in minute crystals. It is, moreover, produced likewise with the separation of sulphur, by saturating an alcoholic solution of the brown sulphohydroquinone with sulphuretted hydrogen. This separation and admixture of free sulphur was formerly overlooked, which explains the incorrect results of the former analyses. The pure compound is yellowish, crystalline, and fuses even below 212° with partial decomposition. Its alcoholic solution gives with acetate of lead a white precipitate, proving, apparently, that it does not contain the sulphur in the form of sulphuretted hydrogen. By pouring a solution of quinone over it, it is converted into brown sulphohydroquinone, with simultaneous production of green and colourless hydroquinone, the formation of which in this reaction had also been overlooked.

Two equivs. yellow sulphohydroquinone furnish, with 1 equiv. quinone, 1 equiv. brown sulphohydroquinone, and at the same time 1 equiv. colourless and 1 equiv. green hydroquinone.

In the formation of this yellow sulphur compound, the elements of 1 equiv. sulphuretted hydrogen combine with the 1 equiv. of the brown compound in such a manner that the 2 atoms of sulphur contained in the latter are eliminated from the combination.

The substances formerly described under the name of *chlorosulphoquinone* are probably merely mixtures of products containing chlorine and sulphur.

Hydrosulphate of Hydroquinone.—Colourless hydroquinone, $C^{12}\ H^6\ O^4$, has the remarkable property of combining in two proportions with sulphuretted hydrogen, forming two beautifully crystalline bodies, which evidently contain the sulphuretted hydrogen as such.

a. The Rhombohedral Hydrosulphate, $3(C^{12}\ H^6\ O^4) + 2HS$, is formed when sulphuretted hydrogen is passed into a cold saturated solution of colourless hydroquinone. It forms very regular transparent rhombohedrons, is void of smell, and unalterable in dry air. When moistened with water, it instantly disengages the odour of sulphuretted hydrogen; and, when its solution is heated to boiling, it is readily decomposed into sulphuretted hydrogen and colourless hydroquinone. It behaves in the same manner with alcohol, and also on fusion alone. With acetate of lead it is converted into pseudo-crystals of black sulphuret of lead. On analysis it furnished:—

	I.	II.		Calculated.
Carbon	58.70	..	36	59.37
Hydrogen ..	5.51	..	20	5.48
Sulphur	8.86	8.71	2	8.81
Oxygen	26.93	..	12	26.34

The amount of sulphur in II. was determined from the quantity of sulphuret of lead formed with acetate of lead; the amount of sulphur in I. was ascertained in the usual manner by heating the crystals with a mixture of calcined marble and nitre, and precipitating the sulphuric acid with a salt of baryta.

b. The Prismatic Hydrosulphate, $2(C^{12}H^6O^4) + HS$, is formed when sulphuretted hydrogen is passed into a saturated hot solution (at about 104°) of colourless hydroquinone; it forms very long colourless prisms, totally different in form from the preceding, but perfectly similar in their behaviour. They furnished on analysis 6.76, 6.95, and 6.66 per cent. sulphur. The above formula requires 6.77.

It is highly probable that the compound $C^{12}\ H^6\ O^4 + HS$ likewise exists; this would contain 12.6 per cent. sulphur.

Combination of Hydroquinone with Acetate of Lead, $2PbO, \overline{A} + C^{12}\ H^6\ O^4 + 3HO$.—Perhaps it would be more correct to regard it as $(PbO, \overline{A} + C^{12}\ H^6\ O^4) + (PbO, \overline{A} + 3HO)$. It was accidentally obtained in the analysis of the hydrosulphate of hydroquinone with a solution of acetate of lead. It is immediately produced when colourless hydroquinone is dissolved in a moderately concentrated hot solution of acetate of lead. It forms oblique rhombic prisms, is very sparingly soluble in cold, but readily soluble in hot, water without decomposition. It parts with its water of crystallization at 212°. The crystals become milk-white, retaining their form even up to 356°; they then fuse, and are decomposed. No corresponding combination with hydroquinone appears to exist.—Liebig's *Annalen.*

THE CHEMICAL TIMES.

SATURDAY, JUNE 30, 1849.

DESTRUCTIVE NUISANCES, AND THE MEANS OF ABATING THEM.

It cannot well be denied that a most anxious desire has been manifested of late on the part both of the Board of Health and of the Commissioners of Sewers to improve the sanitary condition of the metropolis. Unfortunately the nuisances which these public bodies are endeavouring to abate are of so extensive and gigantic a nature, and many of them have been permitted to exist unmolested for a period of time more than amply sufficient to give them something like a prescriptive right of continual existence, that in all probability it will require many years before their complete removal can be effected.

Thus we find, for instance, that in the immediate vicinity of the London Hospital, union workhouse, and parish schools, there exists a congregation of nuisances of the most formidable description, among which boneboilers' yards and colour manufactories are about the

most innocuous. Immediately facing the hospital there are a knacker's yard, at which an average number of 100 horses are slaughtered weekly, and a patent concentrated manure manufacture. From these several premises the most injurious and offensive vapours are constantly exhaling, and produce, of course, the most deplorable effects upon the inmates of the public institutions in their vicinity, and upon the inhabitants of the locality in general. Yet, notwithstanding, they have been permitted to exist unmolested up to the present time, owing, in a measure, it would appear, to the circumstance that some of the most noxious of them are the property of influential members of the two eastern boards of guardians. However, an application was made on Wednesday, the 27th inst., at the Worship-street Police Court, by the managing committee of the London Hospital, with a view to effect the speedy abatement of these most detestable nuisances. We wish the endeavour of the gentlemen who have taken the matter into their hands now may meet with the fullest success. Yet we cannot disguise from ourselves the immense practical difficulties which they will have to encounter in the accomplishment of their object; nor do we think it quite just to deprive any individual by magisterial decision wholly or in part of the right of carrying on his business, without, at all events, offering an adequate compensation for the loss thereby entailed upon him. In our opinion no factory or business of a nature seriously to affect the health of the inhabitants residing in its vicinity should be permitted to exist in the metropolis; but compensation should certainly be given to the present proprietors or exploiters, if they can incontestably prove that they have carried on their present business on the premises for a certain number of years. A compensation clause to this effect would at once deprive the stringent enforcement of the Removal of Nuisances Act of its apparent harshness, and would considerably assist in effecting the object of that act.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL INSTITUTION.

On the 12th inst. Professor Faraday delivered his seventh lecture at the Royal Institution. His Royal Highness Prince Albert occupied a seat in front of the lecture-table. The attention of the audience was principally directed to the peculiar characteristics of the electric spark—its instantaneous action and intensity, &c. The latter peculiarity was shown by its rendering luminous bodies that are opaque in all other light, such as eggs, ivory balls, &c. These, during the transmission of the spark, appear of a luminous purple tint.

To show the rapidity of the passage of electricity, the apparatus invented by Professor Wheatstone was exhibited. A disc, painted in various colours, is made to rapidly revolve; this causes the colours to disappear, and the disc appears white; but on passing the spark before the disc the whole of the colours are distinctly visible, and the disc appears stationary. By this apparatus the duration of the spark had been ascertained not to exceed the five hundred thousandth part of a second; and so intense is it in its action that if a flash of lightning were of longer continuance it would destroy the eyesight. The light produced by the voltaic battery, and termed the electric light, though far exceeding the spark in quantity, is not, by any means, so intense.

The learned professor then drew attention to the phenomena of the aurora borealis and falling stars, which he stated to be simply manifestations of electricity. In the higher regions of the atmosphere electricity passed with nearly equal facility as through wires, the air being in a state of great rarefaction. Here, then, it has the appearance of a flood of purple light; while lower down, the air being more dense, it appears like a falling star, and if in sufficient quantity to penetrate still lower it assumes the form of a flash of lightning. The appearance of the aurora was shown by discharging sparks from Leyden jars through exhausted tubes.

The professor, in conclusion, exhibited the property which static electricity has of magnetizing needles, and of reversing the magnetic poles of those to which magnetism has been communicated.

On the 16th inst. the eighth and concluding lecture of Professor Faraday's course was delivered at the Royal Institution. Atmospherical electricity was the branch of the subject reserved for this occasion, which was rendered more than usually interesting, by the practical application of the science in the consideration of the grandest phenomena of nature. At the commencement of the last century, when little was known of electricity, it had been conjectured that lightning and electricity were identical; but it was not till 1752 that the fact was established by Dr. Franklin, who, by means of a kite, was enabled to draw electricity from the clouds. To illustrate the condition of a thunder cloud, a large bundle of long strips of paper, fastened together at one end, was suspended at the top of the lecture-room, and it was electrified by means of a wire connected with the prime conductor of the machine. The strips of paper, apparently repelled from each other, stood out in all directions, and, after the action of the electrical machine had been continued for some time, the strips continued in a state of repulsion, even when the prime conductor had been completely discharged; the air in the upper part of the room having become charged with electricity, emitted from the ends of the paper, which acted in this respect like so many points. The electrical state of the air was proved in a very curious manner. A piece of cotton wool, steeped in spirits of wine, was attached to the end of a very long fishing-rod, and set on fire. From the flame a wire ran down the rod, and was placed in connection with the electrometer; and, when the flame was elevated to the upper part of the room, it attracted the electricity with which the air was charged, and caused the gold leaves of the electrometer to diverge. The electricity in one part having been thus withdrawn, the flame was moved to another part, with a similar result. As the strips of paper, which were employed to represent a thunder cloud, repelled each other with great activity, it might be supposed that a cloud, when electrified, would be dispersed by the repulsive power; but Professor Faraday observed that the repulsion of the papers was only apparent, the real cause of their separation being the attraction of the walls and of the ceiling around them; and that if they were in the air, with no solid bodies around, they would all be attracted solely towards the earth; the superior attractive power of the earth would overcome all other attractions, and they would be kept together. It is in this manner that the particles comprising a thunder cloud are prevented from being dispersed by the repulsive power which bodies similarly electrified seem to exert upon each other. In alluding to the appearance of a flash of lightning, the professor remarked that its course is never in a straight line, but branches out in the same way that a long spark from the electrical machine does; and though many explanations of this phenomenon have been offered—among them the resistance of the air—yet no cause has been assigned for it which is satisfactory to him. Even the cause of the electrical condition of the upper regions of the atmosphere has not, in Professor Faraday's opinion, been satisfactorily explained; for though evaporation by some, and different states of temperature by others, have been adduced as the cause, he thought it was better to admit ignorance than to mislead by unsatisfactory explanations. The long-continued peals of thunder resulting from one instantaneous flash of lightning had been for some time a difficulty, but the difficulty vanished when it was considered that a flash of lightning may pass through one or two miles, and that sound travels comparatively slowly, so that the sound caused by the disruption of the air at the commencement of a flash of lightning cannot reach the ear until several seconds after the first peal of thunder has been heard. The identification of lightning with electricity has enabled us to place the force of lightning under control, and to conduct it safely to the ground, though in carrying into effect this principle serious mistakes are frequently made by not having the conductors continuous. The destructive effects that may be produced by the smallest disjunction of the conducting wire were illustrated by several experiments, and, even when good continuous conductors are used, considerable danger may arise if they be not sufficiently large. An exemplification of this effect was given by connecting a wire from the prime conductor with several metallic articles in its course to the earth, and, though in this arrangement the sparks were passing freely through the wire, a jet of gas was inflamed on being brought near the metallic bodies with which the wire was connected. The influence of induction was shown in a striking manner by mounting a very large metallic globe on an insulated stand, placed at several feet distance from the electrical machine, and whilst sparks were being taken from the conductor, by a ball held near it, the electricity induced in the globe was sufficient to fire a jet of gas. The importance of taking into consideration the influence of induction, when in operation on the large scale of nature, becomes, therefore, the professor observed, very apparent, and it is of the utmost consequence that their influence should be taken into account in the construction of powder-mills, or of other buildings where inflammable materials are contained. In his concluding remarks Professor Faraday adverted to the allusions he had made at the commencemnt of the course, to the increasing infirmities of age, and the probability of his resigning; but he said he had met with so much indulgence during the delivery of his lectures that so long as that indulgence was continued he would not separate from them. This announcement was received with loud and hearty applause.

Abstract of a Lecture on the Alluvial Condition of the Valley of the Mississippi. By Sir Charles Lyell, Author of "The Principles of Geology."—When a river charged with sediment enters a lake it gains in extent but loses velocity. The sediment, previously kept up solely by the force of the current, falls to the bottom, which, growing shallower and shallower, is in process of time converted into land at the point where the river discharges its waters into an inland sea, as is seen in the encroachment of the delta of the Po on the Adriatic, and in that of the Nile on the Mediterranean Sea. In the Gulf of Mexico the tides are inconsiderable; they are much greater, it is true, than those of the Mediterranean, yet they are not comparable to our tides, or to those of the Pacific. Nevertheless, these tides are quite sufficient to check considerably the advances of the delta of the Mississippi on the domain of the sea. All are familiar with the protrusion, or narrow neck of land, that has been formed by the bringing out of the mud of the Mississippi, which is thrown down at the mouth of the river. The valley which this majestic river has cut for itself is of great depth compared with the swamps of the interior. One of my principal objects in visiting its banks was to collect data for ascertaining at what rate

the mud of the river is deposited, and so calculate backwards the age of the delta. I soon found that, from various circumstances, this was an impossibility. I found from the testimony I was able to collect, as well as from my own observations and calculations, that the change produced from year to year is very great, but the alterations from century to century very trifling, the changes of one year counteracting those of another. When I first learnt that a change affecting half a mile of land was made in one year, I thought it must be very great indeed when multiplied by a hundred, and accumulated at the end of a century; but I soon found out that this was an erroneous way of reckoning. Although the Mississippi sometimes encroaches in one year on the land to the extent I have mentioned, you may still sail (so the pilot assured me) by the charts made 100 years ago. The only difference I could find was, that the Spanish Mexican church was 600 yards nearer the coast than at the time when the charts were constructed. The river is constantly shifting its channels of egress, and the sea recovers at one time the portion it loses at another. During a part of the year the river is low; it then contains less than one third the water it holds in the flood season; at this period the tides enter, and score out the accumulations of mud and sand formed at a previous portion of the year. There is thus a tendency in the course of a century to restore the soundings which have been from time to time disturbed. A mile in a century is the most we can allow for the advance of the land. Linton, the oldest pilot, thought four miles a possible extent of encroachment. The manner in which the river protects its advances is by throwing bars of sand across its bed; in this way the tides are prevented from carrying out very much of the sand and mud, and lagoons are formed. The manner in which the sediment exists in the water is most remarkable. I speak with reference to its extreme state of division. If you were to take a glass of water from the Mississippi, and place it on a table in a state of perfect rest, it would be three weeks or a month before the sediment would subside; and even this period would not suffice for the deposit of the entire quantity. Captains of vessels describe four currents of water as existing one over the other, according to their different densities. The keels of vessels passing through the darkest waters below leave a black track in the middle of the wake of the vessel along the yellow surface water of the river; this black fluid, I believe, does not deposit its sediment, but disperses it far and wide; much of it may get into the Gulf Stream, and be carried thousands of miles. The delta of a river, it may be well to remark, is that portion of a great alluvial formation which lies below the first arm which the river sends off. For 800 miles up the Mississippi from the delta, the bed does not rise more than 200 yards above the level of the sea. The area of the entire delta is 13,600 statute miles; if we take the depth of the mud which has been brought down to form the delta, and the average depth of the Gulf from the prominent point of Florida to the delta, there is a mean depth of 100 fathoms. The borings from which this calculation was made were taken near what must have been the original coast-line, to a depth of 600 feet, without passing through the alluvial fresh-water formation. For the sake of convenience, I have taken the tenth of a mile, to be within bounds, as the depth of mud in the delta. The area being given, we have next to discover the quantity of water flowing out within a given period, and also the proportion of sediment contained in the water. Dr. Ridley, of New Orleans, has made many patient researches into both these questions; he communicated to me, in 1846, some of his results. He has proved that the sediment—carefully distinguishing the difference in quantity in the flood season and the low-water season—is in proportion to the water as 1 to 3000 by volume, or as 1 to 1245 by weight. The mean discharge of water per hour is 339,335 cubic feet. The mean annual discharge of solid matter brought down is thus 3,702,758,500 cubic feet. From these calculations it will appear that the number of years required to bring down the mud of the delta is 67,000. It may be thought that the time thus expressed is somewhat exaggerated. If we have underrated the quantity of water, we have also underrated the quantity of mud brought down in a year; on the other hand, you must remember that we have given all the mud to the delta, whereas a great portion of it is dispersed, and does not go to make up the delta. The pilots told us of anchors of vessels and cargoes which are cast up from six fathoms deep high and dry during the heavy storms which take place in that region, and by the force of conflicting currents. The delta itself gives internal evidence of great antiquity. In some parts the river has encroached till it has reached one of those swamps which are of frequent occurrence on its borders. In these swamps timber has grown, and still grows. Trees have been fossilized, and the condition in which they have been discovered throws much light on the history of the alluvial formation. One of these trees so found is the deciduous cypress, a tree which reaches the great age of 800 years under favourable circumstances, and even has been known to grow through a period of 2,000 years in some parts of Louisiana, as is attested by the number of rings of annual growth.

Dickenson and Brown have shown a succession of growths of timber in these swamps. The deciduous cypress will not grow under water, but if planted on a soil which is for one part of the year exposed to the air the trees will make a start; and if, subsequently, the soil be inundated, will throw up small knobs above the surface, and often manage to grow afterwards in a soil permanently inundated. These knobs are supposed to aërate the roots. The tree will send them up six or eight feet. These trees are found to have grown up by the aid of the knobs for a considerable number of years, when they have gradually rotted, in consequence of the continual action of the water. But they have rotted only down to the roots, which, being imbedded in the soil, were protected from the destructive action of the water. The roots remain until this day, and the rotten vegetable matter has supplied a new soil for a new tree to spring from. Thus we have a succession of growths, one above another; and the remains of these trees, being open to observation, supply us with data for calculating the age of the inundating river. In the north—that is to say, 700 or 800 miles north of New Orleans—is the "Small Country;" this is a district extending about eight miles from north to south, and four from east to west, which was submerged in 1812 by an earthquake. The earthquake continued for the space of three months; it was made up of a succession of violent shocks. I have conversed with many eyewitnesses of its destructive operations. When the wave was passing, the trees would all suddenly lean on one side; then another wave would come, and they would resume their former position, or bend altogether to the other side; then violent crashes would be heard, and the ground would shake beneath the feet. After these undulations of the soil water burst through, coloured with a black matter, owing to the destruction of large beds of coal lying in the coal field beneath the forest. I visited some of the holes ("bursts," as they are called) through which the confined waters made their way, and which, as Baron Humboldt says, are interesting as being the most striking instance of a continued series of undulations affecting a large extent of ground, and distinct from any active source of voltaic influence with which we are acquainted. A part of the ancient forest was submerged at Natobes, where some bones of extinct species of animals were found, such as the megalonyx, the megatherium, &c. It was said that the skeleton of a man had been dug out. The value of this fact, could it have been confirmed in all the particulars with which it was first announced, would have been very great. It would have disproved many of the most important deductions of geological science. We were told that this skeleton was found imbedded with the bones of extinct races of animals, in a manner that would have proved them to be of equal antiquity. The announcement created a great sensation among the public as well as in the scientific world. I visited the spot, and saw the bones. Unquestionably they were the bones of a man; a pelvis bone in particular could not be mistaken. They were in a perfect state, and blackened. Had these bones come out of an undisturbed bed at Nalchoy,—had I seen them taken out, and had I known that they had come from the bottom of the wave, where they had been buried with the megalonyx,—I should have indeed ascribed great antiquity to the human race; but I satisfied myself that they had not been seen by any competent observer to have been dug out of the formation. It is very probable that some Indian grave had at a distant period been dug there. Had the surmises of the discoverers been confirmed they would have proved that the human race existed before the delta or the alluvial formation, and before the sinking of the country, of which there are many evidences. The human race would have seen all the alluvial formation, the assumption of which is necessary to the explanation of the formation we are considering. The country must have sunk 250 feet—man must have seen that. He must have been coexistent with one class of land quadrupeds, and seen them replaced by another. I know of no geological monuments that imply the high antiquity of our race. They all show the comparatively modern origin of man. So far from being able to prove that the human race existed with these extinct species of animals, I have seen no proofs that man is so ancient as the greater part of the other creatures now on the face of the earth. But I will not pursue this question further; it is too tempting. Some geologists will ask me—have asked me—what I consider to be the relative age of this formation; not only the modern formation, but the more ancient alluvial delta, of the Mississippi, with relation to the glacial formation which contains the erratic blocks, spread so widely over large parts of all Europe; and which in America extend much farther south, and go down to the valley of the Ohio. This is a most important question—whether that drift and those transported materials are more ancient than , or are contemporary with, these deposits. I believe the great mass of the drift of America to be more ancient than the deposits to which I have alluded. The old fluviatite formation was decidedly subordinate to that now existing. The drift carries you back to a period when neither the Missouri nor the Mississippi could have drained the country as they now do. Ancient as is the old alluvial formation, the drift must be assigned to a period when the distribution of land and water was very different from that now observed. The old alluvial formation itself is so modern that it contains shells of the same species as now exist.

INSTITUTION OF CIVIL ENGINEERS.

Among the papers read was a "Statement of Observations made on the Initial and Terminal Velocities of Trains in descending Inclined Planes," by Captain W. Moorsom, M. Inst. C.E.

The observations were eighty-two in number, and were made during the ordinary passing of trains on the Waterford and Kilkenny Railway, the gauge of which is 5 feet 3 inches, over two adjoining inclines, each falling at the rate of 1 in 100 for upwards of a mile and a half, with a short intermediate level between them.

The speeds at which the descent was begun varied from 20 to nearly 44 miles per hour, and the loads varied from 32 to 94 tons.

One of the planes presented for the greatest part of its length two curves of a radius of $1\frac{1}{4}$ and 16 miles respectively, and the other plane was straight for part of its length, but contained a curve of $2\frac{1}{2}$ miles radius.

The general results in the more curved plane were, that initial velocities of 20 to 30 miles per

hour, at the top of the plane, became terminal at 24 to 28 miles per hour; and on the straighter plane the same initial velocities became terminal between 29 and 31 miles per hour.

Again, on the more curved plane, initial velocities between 30 and 40 miles per hour became terminal between $29\frac{3}{4}$ and $31\frac{1}{2}$ miles per hour; and on the straighter plane the same initial velocities became terminal at $30\frac{3}{4}$ to $33\frac{1}{2}$ miles per hour.

Initial velocities above 40 miles per hour were noted only upon the more curved plane, and became terminal at 30 to 31 miles per hour. There did not appear to be any constant proportion between the load in motion and the terminal velocity; but the latter appeared to be dependent more upon initial velocity than upon the weight or character of frontage of the trains.

The general practical conclusion was deduced, that the question of gauge had little or nothing to do with terminal velocity derived from gravity, and that the views generally entertained by engineers, during past years, of the great resistances experienced by trains at high velocities were borne out by the observations recorded in the paper.

PROGRESS OF CUTLERY MANUFACTURES.

English steel-makers, it may not be generally known, give much higher prices for the Swedish Danemora (or Oregund) iron than for English iron, and the sales have been to such an extent as to give a monopoly to the sale of the produce of such mines to England; hence it has been worth the attention of Sheffield cutlers to perfect most elaborately articles manufactured from Danemora iron. The cause of the superiority of this iron over English for the fine articles of cutlery has never been explained; but, whether it be the presence of manganese, or silica, or the nature of the process employed, first-character razors can be made from no other iron. The patentees (C. Stewart and Co.) of the new razor —which invention we noticed on its introduction as a great improvement, the razor having a simple movable guard adjusted to it with such precision and nicety that a complete protection to the skin is secured even if the razor were used in a railway carriage, and the beard is removed with the most perfect freedom and accuracy—have exhibited at their establishment, at 22, Charing-cross, some specimens of this Swedish iron, and the razor forged from it. The specimens show the progressive stages of the manufacture of steel for the razor, from the iron in a crude state, or pig, to the rough or blistered steel, the latter in a refined state, the ingot broken to show the fineness of the grain in comparison with the blistered steel; refined steel drawn out in bars preparatory to being forged into razor blades, and the latter in their several states of forging, hardening, grinding, and fitting on the guards, to the completely-finished and highly-polished razor. The simple arrangement of these specimens, each of which is described, is highly interesting, and gives a good general idea of the manipulation of iron and steel, and the various changes it undergoes in the course of manufacture.

The processes of tempering razors, penknives, and tableknives are different. A temperature of 430° to 450° Fahr. being required for razors; for penknives, 470° to 490° Fahr.; while tableknives require 510° to 550° Fahr. The tempering of a razor is not less important than the grinding, since the fineness and durability of the edge depend greatly upon both. Each cutler uses such a heat, and tests it by such signs, as seem best to accord with the result of his own experience. Many razors are made of iron, without being coverted into steel; and thousands are sold at a cheap price made of English iron, which, if submitted to the test the Swedish iron can alone undergo, would fritter away in the subsequent processes, or become honeycombed and porous. Razors are often made from sixpence to several guineas a pair, and it is, consequently, folly to attempt to persuade practical men that a shilling razor, which at the price can only be made from English bar iron, from which the commonest character of hardware is manufactured, for instance, fircirons, &c., has the same fine enduring edge as the razor made from the Swedish iron converted into steel. It gives us pleasure to draw attention to the exquisite superiority and finish of Stewart's patent razors, which must ultimately restore this beautiful class of British manufactures; for, as we have before stated, they make all their razors from the Swedish Danemora iron, applying the best workmanship to its conversion into steel, and the tempering and finish when the razor is forged; and it is gratifying to think that the result shows that we were not wrong in our conclusion that this patent razor, with its guard, would soon become an established favourite, and ultimately supersede the ordinary make of razors.

METROPOLITAN SEWERS.

TO THE RIGHT HON. AND HON. THE METROPOLITAN COMMISSIONERS OF SEWERS.

My Lords and Gentlemen,—The survey committee having, at their meeting on the 15th inst., passed resolutions in reference to the drainage of Westminster, approving in effect the suggestions of Mr. Austin's report of February, 1848, it becomes my duty, as your chief surveyor, to warn you against attempting to execute the works therein contemplated, as I have no hesitation in stating that they are wholly impracticable, and are unworthy the objects which should be kept in view for the perfect drainage of this great metropolis.

Many large and populous metropolitan and suburban districts are now without any drainage, while the public are suffering greatly in consequence, and the drainage of many other districts is in so fearful a condition as to demand at the hands of the commission immediate measures of relief, and the public are daily and justly expressing dissatisfaction at the want of energy exhibited by the commission.

I should hesitate to address you were I not satisfied that it is time for me to speak out, both for the credit of the court and for the reputation of its officers, since, at the last meeting of the court, it was publicly announced that a three-feet pipe would carry off the drainage of the whole of the metropolis. This statement is repeated in the daily papers, and is passing through the provinces with more than usual rapidity. Such an announcement, bearing the sanction of the court, contrary as it is to fact and to all observation, is calculated to bring the commission into ridicule and to destroy public confidence both in the court and its advisers.

The following passage is amongst the conclusions of the first report of the sanitary commission in 1837:—

"The more the investigation advances the more it is apparent that the progressive improvement and proper execution of this class of public works, together with the appliances of hydraulic engineering, cannot reasonably be expected to be dealt with incidentally or collaterally to ordinary occupation, or even to connected professional pursuits, but require a degree of special study, which not only places them beyond the sphere of discussion of popular administrative bodies, but beyond that of ordinary professional engineering and architectural practice.

"In justification of this conclusion, and to show the evil of the perverted application of names of high general professional authority, we might adduce examples of the most defective works which have received their sanction.

"All the improvements which the public have yet obtained in this branch of public works have been the result of the special and undivided practical attention of well-qualified paid officers, and it appears to us that further improvement must be sought by the same means, and that one of the chief objects of future administrative arrangements must be to secure, protect, and encourage the zealous undivided attention and efficient labour of such officers."

I had, therefore, good reason to hope that long ere this the great question of the drainage of the metropolis would have been referred to the surveyors for their undivided attention and report, but the survey committee have ordered plans and estimates involving general principles, by which, without any reference to their chief surveyor, the court may be committed to a course of action of an experimental and most costly nature, the results of which it is impossible to foresee.

For many weighty reasons, one of which is that the discharge of the sewage must, especially in rainy weather, be ultimately into the Thames, far above the present point at which the waters are already polluted, I feel called upon to represent to you that I entirely disapprove of the contemplated mode of operations. The "converging system" cannot prevent the pollution of the river, which can only be completely protected from each day's accumulations by means of a tunnel sewer.

Instead of limiting the attention of the court to minor matters and piecemeal work, such as the drainage of a detached and separate district, to the advantage of a three-inch over a four-inch pipe, or to the shape of a watercloset-pan, the energy of the commission and its officers surely should, in the first instance, have been concentrated on the selection of a sound and thoroughly practical and intelligent plan for providing an efficient outfall, entirely independent of the Thames, for the complete and permanent drainage of the whole of the districts within the jurisdiction of the commission.

Having been thus compelled to thrust myself upon the notice of the court and of the public, and having intimated my objections to the proposed "converging system," it will necessarily be expected that I should state my own views of what ought to be done to meet the urgent necessities of the case.

I propose that about twenty miles of tunnel sewer should be constructed in a slightly and uniformly curved direction, following the general course of, and in respect to sewage as a substitute for, the river, from Kingston, on the western, to the Kent and Essex marshes, on the eastern, extremity of the jurisdiction of the court, at such a depth in the blue-clay formation, say 100 feet below the bed of the river, as would render it independent of all barriers, whether it be the river itself, the Rotherhithe Tunnel, the docks, or any other difficulties hitherto suggested.

This work, the cost of which has been grossly exaggerated, may be extended up the river to intercept the sewage of the towns above, which at present pollute the stream, and down the river, as future occasion may require, possibly even to the sea coast. Views less comprehensive than this should not, I submit, be entertained while considering the foundation of a plan for perfectly and permanently draining the metropolis and the entire valley of the Thames upon the banks of which such a metropolis is situate. But at present the plan embraces only that part of the line before described, which lies between the river below Greenwich up to the King's Scholars' Pond main sewer at Pimlico, a distance of about six miles. Such a work will be as constantly in action as the river cannot get out of repair, and will endure for ages, is simple, economical, and efficient, and will be readily understood and appreciated by the public. It will afford relief at once and alike to all the districts lying below the level of the Thames, and which are now suffering from pent-up filth and drainage in the sewers and open ditches which abound in these extensive districts.

This tunnel sewer will manifestly afford a deep, permanent, and efficient outfall for the effectual drainage of the whole of the low, flat, and densely-populated townships and parishes of Hampton, Teddington, Twickenham, Isleworth, Brentford, Acton, Ealing, Chiswick, Hammersmith, Kensington, Fulham, Chelsea, Brompton, Pimlico, and the city of Westminster to the westward, as

well as to Wapping, Ratcliff, Shadwell, Limehouse, Poplar, Blackwall, and Bromley to the eastward, on the north side of the Thames.

On the south side of the river the tunnel would pass through Lambeth, Southwark, Bermondsey, the lower part of Rotherhithe, and Greenwich, affording facilities for the complete drainage of Kingston, Ham, Petersham, Richmond, Kew, Mortlake, Barnes, Putney, Wandsworth, Battersea, Clapham, Camberwell, Newington, Walworth, Peckham, Hatcham, Deptford, Greenwich, Woolwich, and all the hamlets and suburban villages contiguous to those places, on the south side of the river.

These works stand independently as regards their immediate execution of the Ordnance survey (which is merely a superficial work), or any other preliminaries, and require but a few weeks of levelling and boring preparatory to the actual commencement of the work, and the six miles of tunnel itself might be completed by the end of next year.

I propose that this tunnel should carry off the whole of the house drainage and other waters which at present compose the ordinary flow of the London sewers in fine weather. As the separation of the house drainage from the surface water extends, this quantity would be diminished, and with a constant supply of water would become more regular. There would then be provision for the drainage of the towns above. The capacity of a tunnel for such a purpose I estimate would be eight feet at Greenwich and six feet in diameter at Pimlico, instead of a three-feet pipe, as has been stated to be sufficient. The sewage would be brought to suitable reservoirs or receptacles below Greenwich, pumped up by steam power, and used either in a liquid or a solid state, or both, as may be hereafter determined.

An important feature in this plan is, that the sewage may be raised and disposed of at any point or points of the line of tunnel, where it could be profitably applied for agricultural purposes at any season of the year.

I do not hesitate to assert that the cost of the tunnel, including pumps and machinery, will not be so great as that of the sumps or cesspools and discharging branches of the "converging system," and the annual expenditure and maintenance of machinery with the staff of engineers at each of the numerous stations required by that system will, with the one exception of the engine at the outlet, be entirely saved.

The six miles of tunnel herein proposed would cost under £200,000, and, if the court were to give £50,000 for the first mile of tunnel, I would undertake to get the remainder executed by contract for £26,000 per mile.

A single rate of 7d. in the pound would produce the amount required, and if this were spread over twenty-two years an annual rate for that period of one farthing in the pound would suffice to pay the principal and interest.

I have the honour, &c.,
JOHN PHILLIPS, Chief Surveyor.

1, Greek-street, Soho-square, June 21.

HEALTH OF LONDON DURING THE WEEK.

[From the Registrar-General's Report.]

The total deaths registered in the week were 985, and exhibit an excess, but not more than 22, above the average. The increase, as in the previous week, arises almost exclusively from epidemic diseases, for the deaths in this class were in the last three weeks 251, 251, 277, whilst the average does not exceed 198. Hooping-cough and cholera are alone predominant on the list; the former having been fatal to 55 children, more than the average by 19; and the latter to 49 persons at all ages. Of these 49 deaths from cholera, 11 occurred under 15 years of age, 32 between that age and 60, and 6 at 60 years and upwards. They principally occurred in the south and eastern districts. The progress of mortality from this disease during the last four weeks is marked by the following numbers:—9, 22, 42, 49. The mortality from diarrhœa has rather decreased; for the deaths from it, which in the previous week were 36, in the last week were only 17, whilst the average is 12. All other fatal causes which make the largest contributions to the weekly mortality now exhibit the usual amount, or fall considerably under it. The deaths from phthisis have been for a long period less than the average; last week they were 127, or 18 under the estimated number. A man of 58 years died, according to the return of the medical attendant, of "general decay, probably accelerated by voluntary abstinence, after an illness of 10 days." Two deaths from destitution occurred in Islington workhouse. In Goswell-street sub-district a lady died at the extreme age of 103 years, within two hours after having taken a dose of laudanum, which had been prescribed by a druggist. The mean reading of the barometer at Greenwich was 29.890 inches for the week; the mean daily reading was above 30 inches on Wednesday. The mean daily temperature rose from 54°.9 on Sunday to 67°.1 on Saturday, on which day it was highest. The highest reading also occurred on that day, when it was 78°.6 in the shade, and 106°.8 in the sun. The mean temperature of Saturday was 6°.8 above the average of the same day in seven years, though the temperature of the whole week was rather less than the average.

Fatal cases of cholera registered in the week ending Saturday, June 23, 1849. Four are cases in which inquests were held; the remainder are all certified by medical attendants except two:—

WESTMINSTER.—St. Margaret—In Westminster workhouse, M. 9, "cholera (21 hours)." In same workhouse, M. 5, "cholera (7 hours)." M. 3, "English cholera."

MARYLEBONE.—Christchurch—M. 6, "cholera (12 hours)."

ST. PANCRAS; Somers-town.—At 74, Seymour-street, beadle of St. Pancras Church, 74, "Indian cholera (10 days)." The medical attendant states that "deceased had the premonitory symptoms five days before applying for advice; acute cholera one day, and chronic cholera during four days, making ten days from the commencement of the attack to its termination." Regent's-park.—F. 22, "spasmodic cholic (36 hours); Asiatic cholera (5 hours)."

ISLINGTON; West.—In Islington workhouse, a tramp, M. 19, "natural Asiatic cholera."—Inquest. The deceased was found in company with another lad, both being in a state of destitution and exhaustion. He was brought by the police to the workhouse, and died the day after his admission. The other of the same age also died on the second day after admission, "from want of the common necessaries of life." At 21, Upper Park-street, occupier of the house, and wife of a captain, 54, "cholera (20 hours)."

HACKNEY; Hackney.—A carpenter, 67, "Asiatic cholera (3 days)."—Inquest. West Hackney.—F. 39, "spasmodic cholera (21 hours)."

EAST LONDON; Cripplegate.—At 2, Glovers'-hall-court, F. 11, "cholera (4 days)."

WEST LONDON; South.—At 9, Red Lion-court, M. 35, "Asiatic cholera (10 hours); spasms." At 106, Shoe-lane, F. 32, "diarrhœa (8 days); cholera (4 days); premature labour (32 hours); exhaustion." North.—At 7, Brazier's-buildings, Farringdon-street, M. 63, "cholera Asiatica, suppression of urine (10 days)." In St. Bartholomew's Hospital, wife of a cooper, who resided at 2, Vine-place, Union-street, Spitalfields, "cholera (17 hours)." p.m.

BETHNAL-GREEN; Town.—At 15, Peter-street, Tyssen-street, M. 59, "diarrhœa (5 days); cholera."

WHITECHAPEL; North.—In New-court, George-yard, child of a labourer, F. 2, "malignant cholera." F. 40, taken from New-court, George-yard, to the workhouse, "Asiatic cholera (12 hours)." Aldgate.—A private soldier in the Royal Artillery, 28, "diarrhœa, cholera (13 hours)." Mr. Harris, the registrar, states that "deceased had come from Corfu, where he had been for some time, and was in the habit of getting intoxicated. He had been in the Tower about a month since his return."

ST. GEORGE-IN-THE-EAST; St. Paul.—The two following cases are those of paupers, lately come from Ireland; they occurred at the parochial cholera-house, 3, Bath-terrace:—F. 22, "cholera (40 hours);" F. 24, "cholera (18 hours)." St. John.—At 6, Plough-alley, a labourer, 26, "malignant cholera (29 hours); premonitory signs (24 hours)."

STEPNEY; Ratcliff.—M. 32, "cholera maligna (16 hours)."

STEPNEY; Shadwell and Wapping.—The three following cases occurred at 333, High-street, Wapping:—F. 48, "malignant cholera (17 hours);" F. 68, "malignant cholera (22 hours);" F. 34, "malignant Asiatic cholera (51 hours)."

POPLAR; Poplar.—M. 32, "diarrhœa (3 days); Asiatic cholera (11 hours);" F. 24, "Asiatic cholera (24 hours)."

ST. SAVIOUR; St. Saviour.—M. 41, "diarrhœa (5 days); cholera (18 hours)." F. 60, "Asiatic cholera (17 hours)." F. 54, "Asiatic cholera (31 hours)."

ST. OLAVE; St. Olave.—On the 18th inst., at Rowland's-buildings, son of a costermonger, 5, "English cholera (8 hours)."—Inquest. St. John.—F. 25, "cholera Asiatica (12 hours)."

BERMONDSEY; Leather-market.—F. 50, "Asiatic cholera (4 days)." St Mary.—At Wellington-street, M. 51, "Asiatic cholera (25 hours)." St. James.—M. 42, "Asiatic cholera (2 days)." F. 2, "cholera Asiatica (15 hours)." F. 3, "cholera Asiatica (9 hours), diarrhœa (2 weeks)." F. 65, "Asiatic cholera (28 hours)." F. 46, "cholera." Mr. C. Martin, the registrar, states that "four of the above cases occurred within a few yards of the tidal ditch mentioned before. Parts of the ditch, but at some distance, were closed during the week."

NEWINGTON; Walworth.—At Wood's-buildings, East-street, wife of a waiter, 39, "cholera."

LAMBETH; Waterloo (2d part).—F. 54, "diarrhœa (4 days); malignant cholera (18 hours)."

CAMBERWELL; Camberwell.—At Banbury-court, George-street, a coachman, 35, "spasmodic cholera (6 days)." At 14, Acorn-street, son of a police constable, 2, "cholera (2 hours)." At 10, Queen-street, wife of a carpenter, 41, "natural death; spasmodic cholera."—Inquest. Peckham.—At 2, Burt-place, Old Kent-road, M. 57, "cholera (7 days)." St. George.—On the 17th inst., at 3, Wyndham-road, daughter of a silversmith, 3, "English cholera (3 days)."

ROTHERHITHE; Rotherhithe.—F. 49, "Asiatic cholera (30 hours)."

GREENWICH; Greenwich West.—M. 32, "Asiatic cholera (1 day)." Mr. Richardson, the registrar, states that "deceased was a steward of a foreign steam-boat, and died off Greenwich while being conveyed in a boat to the Dreadnought hospital-ship."

Note.—Mr. J. Leonard, registrar for the sub-district of Charing-cross, states that "during last week diarrhœa became suddenly prevalent in his medical district (St. Martin-in-the fields). On Sunday morning a decided case of cholera presented itself, very bad, but at present with prospect of recovery. The cases are easily managed if taken in time. Two of the severest, one at high-water mark of the river, and the other in Of-alley, occurred within twenty-four hours after a state of intemperance. On inquiry it appears that a large proportion of the out-patients of Charing-cross Hospital are affected with diarrhœa."

ELECTRICITY IN CHOLERA.

[To the Editor of the *Times*.]

Sir,—The letter of M. Audrand, upon the controlling influence of electricity over epidemics generally, and cholera in particular, published by you in to-day's *Times*, induces me to

communicate a fact, in connection with this subject, corroborative of the views of M. Audrand, and which, I believe, has never before appeared in print. One of the Tooting children was seized with cholera in the Royal Free Hospital. The patient was a girl about eight years old, under Dr. Peacock's charge. In about four hours she became completely collapsed, the power of deglutition had ceased, and consequently all internal remedies were useless. Dr. Peacock applied one pole of the galvanic machine over the heart, the other over the region of the stomach, or rather of the solar plexus (a sort of grand central terminus of the nerves, supplying all the viscera). In half a minute the child began to rally, some strong beef-tea was got into her stomach in less than ten minutes, and ultimately the resurrection was complete. Your columns are so much more widely circulated than the medical journals that I trust you will excuse, in this case, a communication that, in one of less urgency, should have been reserved for a professional journal.

I am, sir, your obedient servant,

T. W. Cooke,

Late Resident Surgeon of the Royal Free Hospital.

17, Lower Brook-street, June 25.

ALLEGED EFFECTS OF ELECTRICITY ON THE CHOLERA.

The following is the letter of M. Audrand to the President of the Academy of Paris, respecting his experiments on the decline of electricity in the atmosphere as leading to the increase of epidemic diseases — especially cholera — and which at this time excites so much attention:—

"Paris, June 10.

"M. the President,—Since the cholera has been raging in Paris with more or less intensity for three months, I have made daily observations of the action of the electric machine, in order to ascertain if there is not a certain relation between the intensity of the scourge and the absence of the electric fluid, habitually spread in the atmosphere.

"The machine I have used for my daily observations is rather powerful; in ordinary weather it gives, after two or three turns of the wheel, brilliant sparks of five to six centimetres.

"I have remarked that since the invasion of the epidemic I have not been able to produce on any one occasion the same effect; during the months of April and May the sparks, obtained with great trouble, have never exceeded two to three centimetres, and their variations accorded very nearly with the variations of the cholera; this was already for me a strong presumption that I was on the traces of the important fact that I was endeavouring to find. Nevertheless, I was not yet convinced, because one might attribute the effect to the moisture of the air, or to the irregularities of the electric machine.

"Thus I waited with impatience the arrival of fine weather and heat, to continue my observations with more certainty. At last fine weather came, and, to my astonishment, the machine, frequently consulted, far from showing, as it ought to have done, an augmentation of electricity, gave signs less and less sensible, to such a degree that during the days of the 4th, 5th, and 6th of June it was impossible to obtain anything but slight cracklings, without sparks. On the 7th the machine remained quite dumb. This new decrease of the electric fluid has perfectly accorded, as is only too well known, with the renewed violence of the cholera; for my part I was not more alarmed than astonished; my conviction was complete. I saw only the consequence of the fact already supposed. It may be imagined with what anxiety in these moments of the crisis I consulted the machine, the sad and faithful interpreter of a great calamity. At last, on the morning of the 8th, some feeble sparks reappeared, and from hour to hour their intensity increased. I felt with joy that the vivifying fluid was returning in the atmosphere. Towards evening a storm announced at Paris that the electricity had re-entered its domain—to my eyes it was the cholera which disappeared with the cause which produced it. The next day, Saturday, the 9th, I continued my observations: the machine at the least touch rendered with facility some lively sparks. I have thought it my duty, Mr. President, to give immediate information of these facts to the academy. The question to me seems now perfectly demonstrated, that nature has provided in the atmosphere a mass of electricity which contributes to the support and maintenance of life. If by some cause this mass of electricity decreases, or at any time becomes impoverished nearly to exhaustion, what happens? Everybody suffers; those who carry within themselves a sufficient stock of personal electricity resist; those who can only live by borrowing electricity from the common mass, this mass being exhausted, perish. This explains clearly, and in a rational way, that not only cholera, but perhaps also all the epidemics which from time to time afflict humanity, are caused by the decrease of electricity.

"If this great fact was recognised and admitted in principle, it would be, I believe, easy for medical science, which possesses many means of producing and maintaining electricity, to prepare itself to combat with success, if it should again return, the scourge that now seems to be arrested in its march.

"Receive the assurances, M. le President, &c., "Audrand."

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Frederick Collier Bakewell, of Hampstead, Middlesex, gentleman, for improvements in making communications from one place to another, by means of electricity. Patent dated December 2d, 1848. Enrolled June 2d, 1849.

This invention consists, in the first place, in producing, by means of electricity, copies of writing or print, for the purpose of telegraphic communication; and secondly, of methods of breaking and renewing the electric connection with distant stations.

To carry into effect the first part of the invention, corresponding instruments are made to give equal motions to cylinders; one on each instrument. The instruments are put in motion by weights, and accelerated velocity is prevented by rapidly revolving fans. Parallel to the cylinders are screws, which turn with the cylinders, and on those screws are nuts, which traverse from end to end as the cylinders revolve. To the traversing nuts arms are attached, which carry metal joints that press on the cylinders. On the cylinder of one of the instruments the communication to be transmitted is attached, the message being written on foil with varnish. On the cylinder of the corresponding instrument the paper to receive the message is fixed. The paper is saturated with a mixture which electricity will decompose, prussiate of potass and dilute hydrochloric acid being preferred; and the point (when that mixture is used) should be of iron or steel, so that a mark is made on the paper whenever the electricity passes from the point through the paper. The metal point of each instrument is insulated from the other parts, and the point being placed in connection with the pole of a voltaic battery, and the cylinder with the other, the electric circuit is completed by passing from the points to the cylinders and through the intervening paper. By this arrangement, wherever the point of the transmitting instrument is pressing on the exposed tin foil, the circuit is completed, and a mark is made on the paper; but when it presses on the varnish writing the circuit is interrupted, and the marking ceases. In this manner—as the corresponding cylinders rotate—spiral lines, very close together, are made on the paper, excepting on those parts where the electric circuit is interrupted by the varnish; and, if the transmitting and receiving cylinders rotate exactly together, the points, by passing several times over different parts of each letter, will produce the forms of the letters on the paper.

It is essential to the success of the process that the cylinders should move synchronously. To effect this, electro-magnets are employed, which are brought into action by pendulums actuated by clockwork. Each copying instrument has in connection with it a pendulum, an electro-magnet, and a separate voltaic battery, which battery may consist of a single pair of plates about six inches square. The wires connected with these local batteries are so arranged that the pendulums, as they vibrate, make and break the electric circuit, and bring the electro-magnets into action at each vibration. To the keeper of each magnet an elbow or small bent lever is fixed, the end of which, when drawn down by the magnet, rubs against projections on the rim of the cylinder, which projections are placed at exactly equal distances. In working the instruments they are so weighted that the cylinders may rotate rather faster than the motion required, so that the ends of the levers may touch the projections each time the magnet acts, and thus, by retarding the movements of the cylinders in a slight degree at each vibration of the pendulums, the distant instruments are regulated to move exactly together.

To ascertain whether both cylinders are moving synchronously, a strip of paper is placed across the lines of writing on the transmitting instrument, and, if both instruments be moving accurately, a straight and perpendicular line is made on the receiving cylinder, otherwise the line will be slanting or irregular. By means of this "guide line" the receiving instrument may be regulated by adjusting the pendulum accordingly.

To start the instruments at the same instant, a small electro-magnet is employed, which is brought into action by the electricity transmitted along the telegraphic wires. A bent lever attached to the keeper of this magnet presses against the fan of the instrument, and prevents it from moving; but as soon as the electric circuit is momentarily broken, by the starting of the transmitting instrument, the keeper falls back and releases the fan.

To copy print with these instruments, a portion of the printers' ink may be transferred from printed paper to tin foil by pressure; or the tin foil may be printed on directly from types. In copying print or small writing the cylinder of the receiving instrument should be of greater diameter than the transmitting cylinder, and the screw of the traversing nut be proportionally coarser, in order to produce a magnified copy of the original for greater distinctness.

The patentee describes different modes by which the regulating magnet may be brought into action, and also another mode of copying, by employing several points instead of one, and causing the electricity to pass from point to point in rapid succession. The instruments may be regulated to a velocity of one revolution of the cylinder (six inches in diameter) in two seconds; but a more rapid movement is stated to be attainable. A means is also pointed out of employing the copying telegraph for the transmission and receipt of despatches from all the towns in the circuit every half-hour during the day, in the manner of post deliveries. In the arrangements described only a single connecting wire is employed.

The second part of the invention is carried into operation by bringing into action at each station an electro-magnet, by means of the deflection of magnetic needles on the main wire, to break the connection with that station and the earth, and to throw the next station into circuit.

The specification is accompanied by illustrative engravings.

The patentee claims as his invention:—

First. The arrangements described for copying, by means of electricity, written or printed characters for telegraphic communication.

Secondly. The employment of electro-magnets, as described, for the purpose of regulating the continuous movement of distant instruments, either with or without the application of pendulums.

Thirdly. The use of preconcerted marks or lines, on the transmitting instrument, to serve as guides in regulating the distant instruments.

Fourthly. The arrangements described for breaking and renewing the electric circuits, by means of electro-magnets and local voltaic batteries, brought into action by the deflection of needles on the main telegraphic wire.

John Lane, of Liverpool, and John Taylor, of Liverpool, engineers, for improvements in engines, boilers, and pumps; in railway carriages, in propelling vessels, in the construction of boats, in extinguishing fire, and in brewing. Patent dated November 29th, 1848. Enrolled May 29th, 1849.

This invention has reference, first, to what the patentees are pleased to denominate a "novel arrangement" of that class of engines commonly called rotary engines, such novel arrangement being also applicable to pumps for the purpose of raising or forcing water and other fluids, amongst which uses it may be employed with advantage in the extinguishing of fires.

Secondly. To a novel arrangement of parts of railway carriages, whereby the acting of the break upon the wheel (when the breaks of the different carriages are connected together so as to be simultaneously acted upon) will be rendered uniform, although the relative position of the different carriages composing the train may be constantly varying.

A detailed description of these two improvements would be unintelligible, in the absence of the illustrative engravings which accompany the specification.

The third improvement refers to a novel method of building boats, viz., with flexible ribs, so that in the event of concussion of one with another, or against any unyielding substance, less injury will result therefrom. These ribs are represented as being made of metal, and covered with vulcanized indiarubber, and the shell of the boat formed of some similar substance. The seats of these boats are fitted so as to be readily removable, for the purpose of stowing one boat within the other, in order to effect a saving of room. In constructing boats which are resorted to in cases of shipwreck, the patentees adapt light air chambers thereto, immediately on the outside, but not connected with the gunwale. These chambers are supported on a number of arms, which pass through the sides, and slide close under each seat, so that in the event of the boat being subjected to the action of the waves these air or buoyant chambers may be projected a considerable distance from the side of the boat, imparting the same buoyancy thereto, and at the same time rendering them much less liable to be capsized.

The fourth part refers to the hanging of rudders of vessels in such manner as to render the steering much more easy than by the ordinary rudder, which it is well known is hung entirely on one side of the centre or rudder part, on which it oscillates; instead of which the patentees place such centre or post about midway of the rudder's surface (the same as adopted in the Thames boats Cricket, Ant, and Bee), so that the water takes effect as much on one side of the centre as the other, neutralizing thus the effect so far as regards the power required to vary the position of the same. In boats propelled by the screw this rudder is shown placed in the dead wood, with the propeller-shaft passing directly through the centre of the rudder and stern-post to the propeller, which is on the extreme end of the shaft. A portion of the rudder surface is cut away where the shaft passes it, and the post or shaft on which it is supported is made with an oblong loop, to admit of the necessary motion of the rudder.

The fifth part consists in the application of a refrigerating apparatus to a close copper, used for boiling worts, in such a manner that the products passing off from the boiling worts shall be again returned into the copper. The copper back employed in brewing, according to this invention, is enclosed, and furnished with a pipe, which conveys the products arising from the boiling into a refrigerator or worm tub, having passed through which it is conveyed back into the copper by a pipe proceeding nearly to the bottom of that vessel. This apparatus is, in fact, exactly similar to an ordinary still, with the exception that the proceeds are not in that case conveyed back into the original vessel. The boiling is conducted in the ordinary manner at about 160°, regulating the heat according to the quantity of water introduced to the copper back. By conducting brewing operations in this way, the patentees consider the character and quality of the beer are much improved.

In connection with brewing a further improvement is given, which consists in the adaptation of a floating tray to the working tuns or vessels when brewing. These trays are constructed so as to cover the area of the tun, and float on the surface of the liquor therein. This tray is perforated, and the barm is received in the tray, which allows the more fluid portion to run through into the tun. The tuns are covered in by hinged lids, to prevent the action of the air on the barm.

The patentees do not confine themselves to the precise details, so long as the peculiar character of either part of their invention be retained; but what they claim is:—

First. The mode of arranging the parts of rotary engines and pumps, as described in the specification.

Secondly. The mode of arranging cords, chains, or straps, and the parts connected therewith, in the application of breaks to the wheels of railway carriages, as described in the specification.

Thirdly. The mode described of constructing the parts of boats.

Fourthly. The mode described of constructing and hanging rudders.

Fifthly. The arranging brewers' coppers in combination with refrigerators, in such manner as to return the products back to the copper; and also the application of what the patentees call a floating tray to the working tuns or vessels used when brewing.

Henry Kempton, of Pentonville, in the county of Middlesex, gentleman, for improvements in reflectors, and apparatus for artificial light. Patent dated November 7th, 1848. Enrolled May 7th, 1849.

The apparatus described in this specification relates:—

First. To the mode of constructing reflectors generally, and the materials of which they are composed.

Secondly. To the adaptation and application of these reflectors to various purposes; and apparatus for artificial light, as also the apparatus itself, used in the production of artificial light.

The patentee proposes to make the reflectors of earthen or potters' ware, and coating the interior which form the reflecting surfaces with silver lustre, in the manner well known in the ordinary manufacture of other articles of the same materials, as teacups, &c.

The patentee makes no claim to the process of silver lustring the surfaces of earthenware, as that process is well known; but he considers the peculiar application of it to the purpose of reflectors new.

He then describes and shows the application of this description of reflectors to various purposes:—

First. To a gas-lamp applied externally to shop windows. A reflector of the above-described construction is applied in the ordinary manner, and a convex glass front is attached to it. The pipe for the supply of gas to the burner passes down inside the glass chimney, whereby it is heated previous to combustion.

Secondly. To a signal-lamp for railway purposes. The reflector is here made of a parabolic form, and the burner is attached to it, so that there is less liability of the flame getting out of the focus of the reflector than usual.

The third application is to a mode of constructing a burner for consuming gas, and which the patentee calls a "cornucopia burner." It merely consists of a jet of gas issuing from an aperture in a horizontal direction, instead of, as usual, in a vertical one. The flame is enclosed in a glass of a cornucopian shape, the mouth or larger end of the glass opening upwards. The air, to assist the combustion, finds ingress at the bottom or smaller end of the glass, just behind the jet or burner. A reflector of the above description may be applied to the larger end of the glass, above the flame, or the burner may, if desired, be used without a reflector. In this mode of effecting the combustion of gas the flame throws no shadow from the apparatus forming the burner upon the table or space below it, that shadow being thrown back upon the pipe.

Fourthly. To a drop-lamp for railway carriages. The lamp itself is of the ordinary construction, and the reflector is of a circular form, and secured to the under side of the roof of the carriage, there being an aperture in the centre through which the lamp is suspended.

Fifthly. To the ordinary street-lamp. The upper part of the lantern is in this case composed of reflectors, in place of the panes of glass as is usually the case.

Sixthly. To a gas-stove for the purpose of warming apartments. The jets of gas are placed in the focus of a large parabolic reflector, made as above described; or a coal fire may be placed in its focus instead of the gas jets. The light and heat are thus reflected into the apartment.

The patentee claims:—

First. The manufacture of reflectors of pottery or earthen ware, and coated on the reflecting surface with silver lustre.

Secondly. The mode of supplying gas to burners through the interior of the glass chimney, and also the application of a convex glass front; also the arrangement described of a signal-lamp. Also the mode of constructing the cornucopian burner, as described. Also the construction of the tops of street lanterns with the reflectors. Also the application of the reflectors to railway-carriage lamps. Also the arrangement of gas-stoves, as described.

Robert Thomson Pattison, of the city of Glasgow, in Scotland, printer, for an improved preparation or material for fixing paint or pigment colours on cotton, linen, woollen, silk, and other woven fabrics. Patent dated November 2d, 1848. Enrolled May 2d, 1849.

This improved material for fixing colours in woven fabrics is produced from milk, and is prepared by a very simple process, either from sweet milk (*i.e.*, fresh from the cow) or what is termed "skimmed" milk, or butter milk may be employed instead with economy and advantage. If butter milk be used, this should be taken as recently after the churning as possible, when it is to be placed in a boiler, and heated to 160° Fahr., which will cause the curd or thick part to be deposited; the whey is then to be removed, and the curd subjected to pressure in the ordinary cheese-press, in order to free it as much as possible from the adherent whey and moisture. The granulated mass thus obtained is to be spread out on trays made of some finely-reticulated material, and placed in a drying chamber, in which the heat from a stove is caused to pass up through the trays, and the material spread out thereon. The dried material is then reduced to a fine powder, by the ordinary process of grinding flour; or it may be subjected to crushing rollers similar to those used for crushing madder. This powder the patentee denominates "lacterine." In using new or skimmed milk for the purpose, the precipitation of the curd is effected in a similar manner, but with the addition of a little

acid, to disengage it from the whey. Most acids answer this purpose, but the patentee prefers the use of oxalic acid. The pressing and grinding is effected in the manner just now described with reference to butter milk.

Having thus described the mode of extracting the lacterine, the patentee proceeds to explain the mode of preparing the colouring matter with lacterine, for the purpose of printing, which mode, however, must be left in a great measure to the judgment of the printer, as no positive rule can be given for all colours, or shades of colour. The patentee selects for illustration ultramarine blue, of a medium shade. He takes two gallons of water in a suitable vessel, and mixes with it eight pounds of the lacterine. He then adds four ounces of liquor of ammonia, which has the effect of dissolving the lacterine and converting the whole to a mass of gummy consistence. In another vessel, containing one gallon of water, he dissolves twelve pounds of ultramarine blue, and, the whole being well dissolved, he mixes the contents of both vessels intimately, and afterwards strains the mixture through a fine cloth, in order to separate the coarser particles, and to remove all extraneous matters from the preparation. The colouring matter thus obtained is now ready for use, for the purpose of printing woven fabrics; the operation of printing and the stretching and finishing processes are performed in the usual manner. The advantages resulting from the use of lacterine are—increased facility in the printing the woven fabrics, and fixing the colouring matters therein ; the cheapness of the material extracted from milk compared to the price of that which is generally employed for a similar purpose.

In conclusion the patentee observes that he does not claim any of the apparatus employed in extracting or otherwise preparing the lacterine, as this process may be performed in a variety of other ways. Neither does he confine himself to the description of milk mentioned, considering that all others come within the meaning of his invention; but that what he claims as his invention is the making or manufacturing the material called "lacterine" from milk, which material possesses the property or inherent quality necessary for the fixing of prints or pigment paints in woven fabrics. He also claims, of course, the use of such material for that purpose.

PATENTS RECENTLY GRANTED.

Joseph Burch, of Craig Works, Macclesfield, engineer, for improvements in printing on cotton, woollen, silk, paper, and other fabrics and materials. Patent dated June 14th, 1849; six months.

Peter William Barlow, of Blackheath, civil engineer, for improvements in parts of the permanent ways of railways. Patent dated June 14th, 1849; six months.

Henry Mills Stowe, of Bermuda, master of the brig *James*, for improvements in blocks and sheaves. Patent dated June 20th, 1849; six months.

Alexander Francis Campbell, of Great Plumstead, Norfolk, for improvements in wheels, ploughs, and harrows, steam-boilers, and machinery for propelling vessels. Patent dated June 20th, 1849; six months.

William Combauld Jacob, of Bread-street, in the city of London, warehouseman, for improvements in the manufacture of parasols and umbrellas. Patent dated June 20th, 1849; two months.

Richard Archibald Brooman, of the firm of Messrs. J. C. Robertson and Co., of Fleet-street, London, for improvements in apparatus for transferring liquids from one vessel to another, and for filling bottles and other vessels with liquids. Patent dated June 20th, 1849; six months. (Communication.)

Charles James Coverley Griffin, of Southwark, hatter, for certain improvements in military accoutrements. Patent dated June 20th, 1849; six months.

Edward Lyon Berthon, clerk, bachelor of arts, of Fareham, in the county of Southampton, for an instrument to show the velocity of a ship or other vessel propelled through the water, by wind, steam, or other moving power. Patent dated June 20th, 1849; six months.

Samuel Colt, of Trafalgar-square, in the county of Middlesex, gentleman, for improvements in firearms. Patent dated June 20th, 1849; six months.

PATENTS RECENTLY EXPIRED.

J. Whitworth, of Manchester, machinist, for certain improvements in machinery, tools, or apparatus, for turning, boring, planing, and cutting metals, and other materials. Patent dated June 11th, 1835; expired June 11th, 1849.

E. Carter, Exeter, gentleman, for an improved apparatus for regulating the supply of gas to the burners, and for the stopping off the same; applicable also as a cock in drawing off or regulating the flow of other fluids. Patent dated June 22d, 1835; expired June 22d, 1849.

J. W. Fraser, London, artist, for improvements in apparatus for descending under water. Patent dated June 22d, 1835; expired June 22d, 1849.

J. Mitchell, Truro, for an improved process in smelting argentiferous ores. Patent dated June 22d, 1835; expired June 22d, 1849.

MANUFACTURE OF GOOD CRUCIBLES.

This is a branch of the potter's art requiring great care to ensure success, and has generally been considered a very uncertain process. A good crucible is required to stand the greatest heats, and to withstand the corrosive effects of any substance ignited in them, also to stand sudden changes of temperature. Good crucibles must be composed of a material sufficiently solid in its texture to prevent the passage of the fluid metal through its pores. The composition producing pots of the best quality is formed by pure fireclay, mixed with finely-ground cement of old crucibles, to which is added a portion of black-lead or plumbago. The clay is prepared in the same manner as observed in potteries generally; the vessels, after being worked to the proper conical shape, are slowly dried, and then baked in a kiln. The composition used in the Royal Foundry of Berlin is formed of 8 parts in bulk of Stourbridge clay and cement, 5 of coke, and 4 of graphite or plumbago. Crucibles manufactured from this mixture are capable of withstanding the greatest possible heat, in which wrought iron melts, being equal to from 150° to 155° Wedgewood: they also bear sudden cooling without cracking. In the Berlin Foundry they have been employed for twenty-three consecutive meltings of 76lbs. of iron each, which perhaps is the most complete and trying test that could be adopted.

Another composition is as follows:—8lbs. Stourbridge clay; 4lbs. burned clay cement; 2lbs. coke powder, and 2lbs. pipeclay; the whole being compressed in moulds whilst in a pasty state.

Mr. Anstey's patent process for the manufacture of crucibles is as follows:—Two parts of finely-ground raw Stourbridge clay, and one part of the hardest gas coke, previously pulverized, and sifted through a sieve of one-eighth inch mesh, are mixed well together with water. This mixture is moulded on a revolving wooden block, somewhat similar to the process pursued in pot-throwing, a gauge being used to regulate the thickness of the pot, and a cap of linen placed upon the core previous to the application of the clay, in order to prevent its adhering when removed. The pot is then dried in a gentle heat, and is not thoroughly completed until required for use. It is then warmed before a fire, and laid in the furnace, with the mouth downwards, the heat of the fire having been previously lowered by the application of fresh coke. The furnace is then filled with coke sufficiently high to cover the crucible, when it is gradually brought up to a red heat. When this is the case it is reversed, and fixed in its proper position in the furnace, without being allowed to cool. The charge of metal is then put into the crucible, and three or four large pieces of coke are placed across the mouth of the pot, the tile or lid is then put down, and the draught of the furnace adjusted to heat the metal quickly.

REMARKABLE STATEMENT.—An eminent physician of Paris, Dr. Bonet, has written to a professional brother in this town statements so startling in reference to the results of a very simple mode of treating, in the worst stages, the disease now so fatally prevalent in Paris, that we deem it our duty at once to lay it before the public. The letter, of which the following is a translation, is dated Paris, June 18:—"I think it my duty to inform my professional brethren that, in a great number of patients affected with cholera in the last stage, that is to say, when the pulsation of the heart and the movement of the pulses are absent, and in the commencement of the blue stage, I have succeeded in restoring the action of the heart and in recovering the patient from the blue stage by administering, at intervals of half an hour, four cups of a hot and sweetened infusion of the common lime-tree, mint, balm, or chamomile, &c., in each of which cup of infusion were four drops of volatile alkali, making sixteen drops, which the patient may take in two hours. The reaction is almost instantaneous. The pulse commences instantaneously to beat, rather irregularly at first, it is true, but afterwards with force, the blue state disappears, the body, face, and extremities are covered with hot and copious sweat, and in a few hours the patient is entirely out of danger. It is frequently necessary to combat the reaction when it becomes too strong by the assistance of bleeding."—*Liverpool Albion.*

IMPROVEMENTS IN THE MANUFACTURE OF SUGAR.—Considerable interest has been excited in the scientific and commercial world by the announcement of the discovery of some considerable improvements in the manufacture of sugar. This discovery was first attributed to the celebrated chemist, M. Dumas, and ten per cent. stated as the amount of improvement to be effected. M. Dumas, however, states that it was a former pupil of his (M. Milsens, of Belgium) who has made the discovery; that the details furnished to him of the results of the numerous experiments made by M. Milsens were of the greatest correctness; and that they had been repeated by him with most complete success. This process is so simple, and so easy of execution, that it would be very difficult for M. Milsens to protect his interests in any patent that he might take out; it is, therefore, proposed that a national recompense should be adjudged to M. Milsens in consideration of his discovery, and the process published for the public benefit.

THE BRITANNIA BRIDGE OVER THE MENAI.—The abutments, on either side of the Straits, are huge piles of masonry. That on the Anglesea side is 143 ft. high, and 173 ft. long. The wing walls of both terminate in splendid pedestals, and on each are two colossal lions *couchants*, of Egyptian design, lifting their limestone foreheads in the face of every train. These lions, like the tube they adorn, are on a gigantic scale, each being 25 ft. long, 12 ft. high, though crouched, 9 ft. abaft the body, and each paw 2 ft. 4 in. Each weighs 30 tons. There is some intention of surmounting the central tower with a colossal figure of Britannia, 60 ft. high. The towers for supporting the tube are of a like magnitude with the entire work. The great Britannia Tower in the centre of the Straits is 62 ft. by 52 ft. at its base; its total height from the bottom, 230 ft.; it contains 148,625 cubic feet of limestone and 144,625 of sandstone; it weighs 20,000 tons; and there are 387 tons of cast iron built into it in the shape of beams and girders. Its province is to sustain the four ends of the four long iron tubes which will span the Straits from shore to shore. The total quantity of stone contained in the bridge is 1,500,000 cubic feet. The side towers stand at a clear distance of 460 ft. from the great central

tower; and again, the abutments stand at a distance from the side towers of 230 ft., giving the entire bridge a total length of 1,849 ft., corresponding with the date of this present year of grace. The side or land towers are each 62 ft. by 52 ft. at the base, and 190 ft. high; they contain 210 tons of cast iron.

Tubes of the Britannia Bridge.—The length of the great tube is exactly 470 ft., being 12 ft. longer than the clear space between the towers, and the greatest span ever yet attempted. This additional length is intended to afford a temporary bearing of 6 ft. at each end, after they are raised into their places, until there is time to form the connection between them across the towers. Their greatest height is in the centre 30 ft., and diminishing towards the end to 22 ft. Each tube consists of sides, top and bottom, all formed of long narrow wrought-iron plates, varying in length from 12 ft. downward. The direction in which these plates are laid and riveted together is governed by the direction of the strains on the different parts of the tube. They are of the same manufacture as those for making boilers, varying in thickness from three eighths to three fourths of an inch. Some of them weigh nearly 7 cwt., and are amongst the largest it is possible to roll with any existing machinery. In the sides the plates are 6 ft. and 8 ft. long, and half an inch thick; but the longest plates are in the bottom, being 12 ft. long by 2 ft. 4 in. wide, arranged in double layers. At the top they are 6 ft. in length and 1 ft. 9 in. in breadth. The connection between top, bottom, and sides is made much more substantial by triangular pieces of thick plate, riveted in across the corners, to enable the tube to resist the cross or twisting strain to which it will be exposed from the heavy and long-continued gales of wind that, sweeping up the Channel, will assail it in its lofty and unprotected position. The rivets, of which there are 2,000,000—each tube containing 327,000—are more than an inch in diameter. They are placed in rows, and were put in the holes red hot, and beaten with heavy hammers. In cooling they contracted strongly, and drew the plates together so powerfully that it required a force of from 4 to 6 tons to each rivet to cause the plates to slide over each other. The total weight of wrought iron in the great tube is 1,600 tons. The trains will pass through over the Straits at 100 ft. above high water.

Prof. Bunsen announces that, in continuation of his researches on the "Pseudo-Volcanic Phenomena of Iceland," he has succeeded, experimentally, in producing some important exemplifications in proof of the formation of the trap rocks which will prove an important addition to physical geology.

M. de Senarmont has been successful in forming several minerals by the humid way, which appear to throw much light on the processes employed by nature in the formation of mineral veins, and many of the earthy minerals found in the granitic rocks. He encloses in a strong glass tube, hermetically sealed, the substances to act upon each other, as, for instance, sulphate of iron and carbonate of soda in solution. The tube being cautiously sealed is placed in a gun-barrel half full of water, and, this being also closed, the whole arrangement is exposed to the action of heat. Double decomposition of course follows the mixing of the above salts; but under the increased pressure and temperature the carbonate of iron is redissolved, and eventually deposited in crystals of a greyish-white character, which are not altered by exposure to the air. In a similar manner crystallized carbonate of magnesia and manganese have been formed.

We learn that Mr. Frankland, who has for some time been pursuing his chemical studies in the laboratory of Professor Bunsen, of Marburg, has discovered ethyl, the base of ether. The isolation of this interesting base will doubtless tend to the elucidation of many involved questions connected with the phenomena of etherification; and it must consequently prove of great interest to all chemists.

TO CORRESPONDENTS.

☞ Having received numerous inquiries regarding the index published with No. 146, we beg to call the attention of our correspondents and subscribers in general to the following notice which appeared in the same number at the head of the column devoted to correspondents:—"The Index which we publish with this number comprises the contents of No. 115 to 140 inclusive. No. 140 finishes the fourth volume. Our subscribers are requested to alter 'Vol. IV.' to 'Vol. V.' on the first page of 141 seqq." With regard to the exordinal numeration of the pages of No. 141 to 145 inclusive, we intend to publish a separate index for these five numbers, and to affix this as a headpiece to the general index for Vol. V., with which volume we recommend our subscribers to have them bound. It was our intention to close Vol. V. with No. 166 (November 3). We have, however, since received the following suggestion from a valued correspondent, which we beg to submit to the consideration of our subscribers:—"Those who possess the organ of order largely developed must see greater fitness in the two biennial volumes corresponding to the calendar year. May I suggest, therefore, that the fifth volume be continued to the end of December?" Should this suggestion meet with the general approbation of our subscribers, we shall be happy to act upon it. This would bring Vol. V. down to No. 174 (December 29).

"H. R." sends us the following strange paragraph, which, he says, appeared in the *Globe* of Tuesday, the 26th inst.:—"*Lord Ducie on Mesmerism.*—Earl Ducie has consented to become president of a 'Mesmeric Institute,' which has just been formed in Bristol. His lordship stated, 'He felt bound to tell them the history of his conversion, for he used to laugh as much at mesmerism as any person in that room could do. Some years ago he had suffered much from gout and other affections. One day a clergyman, a friend of his, came to him in great glee, and told him that he had it in his own power to be cured. His informant went on to tell him that he had been cured by clairvoyance of a nervous attack he had suffered from for many years. If he was not afraid, he was recommended to go to a curative clairvoyante. Being piqued on his being afraid of going, he sent for the lady, laughing, he must confess, at the whole affair. He was, however, cured after being mesmerized regularly for some time. The very first time the lady operated on him, by taking his hand and making the passes, he went soundly to sleep, and every time after he did not know when the lady left the room. He then went daily, for about four months, to a London surgeon who practised mesmerism, and every day he saw proof of the science. On one occasion, when he still rather doubted the truth of clairvoyance, this surgeon asked him (Earl Ducie) to accompany him to see an interesting case of clairvoyance on whom he was going to operate. He explained his wish to do so, but the necessity for him to leave on other business. The surgeon rang the bell, called in a girl of about eighteen years of age, and, mesmerizing her, left the room. He (Earl Ducie) then, finding her clairvoyante, began to question her. They then travelled mentally to the railway station, the clairvoyante expressing her wish to go into the country, as she had not been there for many years. He then, *selon la règle*, asked her to go into Gloucestershire, and went down to his mansion. She described the gravel walk, the iron gates, the hall—she described its checkered pavements, the musket and cartouche-boxes on the wall, the carved fireplace of his Elizabethan house. They then went over his farm, and she descried the crops of his fields, occasionally seeming puzzled at the plants, and mistaking, as a Londoner might, turnips for potatoes. The singular proof of her clairvoyance was, that she noticed to him that one field in particular was planted with two different crops; she noticed this, and told him that part of the field was cut and carried, and the other remained; he found this afterwards to be true, although he actually at the time did not know it himself. The lady by whom he was cured told him several things about himself which he thought no one in the world knew. There could be no collusion in the case, for he had never seen the girl before, and she did not know his name or residence, and, if she had been informed, she could not have known all the details of his farm in Gloucestershire. He might mention that the same girl alluded to a fine chestnut-tree on his estate, and mentioned that it was surrounded by an iron fence, describing the long fan-like leaf of dark green with the most perfect exactness, although perfectly ignorant, as a girl living in London would be, of the sort of tree.'" H. R. asks us whether we believe this statement to be true, and what is our opinion of mesmerism in general. We have a strong notion that the whole matter is a hoax. We should be sorry, indeed, to see a nobleman of Lord Ducie's character mixed up with mesmerism and its professors. A girl endowed with the clairvoyance attributed to this one in the paragraph in the *Globe* would prove an invaluable acquisition to the Stock Exchange. She might be made to travel mentally to Rome, to the Waag, to the banks of the Neckar, for the purpose of obtaining the most accurate information of the actual state of affairs in these parts. Seriously speaking, of all the gross impositions upon public credulity of which the charlatans who profess the so-called science of mesmerism have ever been guilty, the one before us, and into which the name of Lord Ducie has been dragged (we most truly and sincerely believe, entirely without his knowledge), is certainly the grossest.

"R. M. C."—The process by which the article in question is prepared is a secret. And even though we might happen to know the whole of the ingredients, together with the *modus operandi*, we should not feel disposed to make our knowledge public. Were we to do so it might inflict a serious injury upon the proprietor and inventor. In fact, we make it a rule never to divulge secret processes.

"Mr. H. D. Gardner, Gorey, Jersey."—We refer our correspondent to the answer given to R. M. C. The best advice which we can give to Mr. Gardner is to procure Mr. Hooper's preparation of taraxacum. He will derive very considerable benefit from its use.

"An Apothecary."—Liable to the stamp duty.

"A Pupil."—1. Procure Fresenius' "Qualitative and Quantitative Chemical Analysis." 2. Messrs. Horne, Thornthwaite, and Wood, opticians, 123, Newgate-street, London.

"M. D."—The best method of charring the surface of wood is to wet it with the most highly concentrated oil of vitriol. By this means you carbonize not only the outer surface, but the surface of all the cracks and holes.

"Tyro."—Hydrogen *is* a metal, however absurd the notion may appear to Tyro. It is, in M. Dumas' words, "a gaseous metal, even as mercury is a liquid metal."

"A Lady Reader."—Take a quarter of a peck of flour, and rub into it a pound of butter very fine. Make it up into a light paste with cold water, just stiff enough to work well. Lay it now out about as thick as a crown piece; put a layer of butter all over; sprinkle on a little flour, double it up, and roll it out again. Double and roll it with layers of butter three, four, five times, or more. Bake in a moderately quick oven.

"A Housewife."—The powder sent to us by our fair correspondent contains no chicory, nor coffee either. It is simply the so-called rye coffee, or Hunt's economical breakfast powder, and consists purely of rye roasted along with a little fat. There is, of course, nothing hurtful in it.

"Mr. Wortham, Leeds."—We cannot undertake to answer such a string of questions as you have sent us, more particularly as most of them relate to secret and patented processes, which we have no right to divulge, even though we may happen to know them.

The Chemical Times is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentleman may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary or scientific communications to be addressed to the Editor, 320, Strand.

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ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXIII.

(LECTURE XCVI.)

VEGETO-ALKALIS—(*Continued*).

NARCOTINA.

This alkali was discovered by M. Derosne.

The formula is:—

$C_{40} H_{20} N_1 O_{12}$.

Narcotina is white and inodorous. It forms prismatic crystals; it fuses at 338° and solidifies at 266° Fahrenheit, the solidification being attended with a loss of weight to the extent of 3 to 4 per cent., owing no doubt to its state of hydration. If it is cooled slowly several centres of crystallization form at its surface, which gradually increase in size.

Narcotina is insoluble in cold water, and very slightly soluble in boiling water, one part of the alkali requiring 500 parts of the latter menstruum for its solution.

It requires 100 parts of cold alcohol for its solution, but dissolves more readily in boiling alcohol. It is very soluble in ether, which property distinguishes it from morphia. It is equally soluble in fixed and volatile oils.

Narcotina is without action on the persalts of iron; it does not decompose iodic acid.

Nitric acid colours narcotina red. Hyponitric acid exercises so energetic an action upon this alkaloid, that, if the quantity of matter acted on is not altogether insignificant, inflammation ensues in a few seconds.

Narcotina combines with the powerful mineral acids. Hydrochloric and sulphuric acids form stable compounds with it. Acetic acid at 7° areom. dissolves a very copious amount of narcotina; but on heating the solution the alkaloid precipitates instantly.

The salts of narcotina are more intensely bitter than the morphia salts. They are precipitated by infusion of gallnuts. Potass and soda precipitate them like the salts of morphia, but the precipitate is not redissolved upon addition of an excess of alkali. The salts of narcotina are not coloured blue by the persalts of iron.

The hydrochlorate is the only narcotina salt that has been studied. According to M. Robiquet, the best way to obtain this salt in the crystalline form is to evaporate the solution of narcotina in hydrochloric acid to dryness, and to redissolve the residue in boiling alcohol. From this solution the salt crystallizes in needles, which frequently present a greenish hue.

To procure narcotina, take the opium grounds left after the extraction of morphia by water; boil them with acetic acid at 2° or 3° areom.; strain and filter the liquid, and precipitate the filtrate with ammonia. Purify the precipitated narcotina by resolution in boiling strong alcohol, to which add a small quantity of animal charcoal; filter the solution boiling. The narcotina will crystallize from the filtrate on cooling.

NARCEIA—MECONIA—THEBAINA.

Narceia, discovered by M. Pelletier, and meconia, discovered by M. Dublanc, and studied more intimately by M. Couerbe, are two matters essentially distinct from the preceding alkaloids of opium in this, that they do not, like the latter, combine with acids. Narceia contains nitrogen: meconia is without this element. Those two bodies, though highly interesting in a chemical, are of no importance in a medical, point of view, since neither exercises any action on the animal economy.

Thebaina or Paramorphia resembles narceia and meconia in this, that it is equally non-susceptible of forming salts. In other respects it bears the strongest analogy to narcotina, from which it differs. however, in the following points:—It crystallizes in short needles, fuses at 266° Fahr., is much more readily soluble in alcohol than narcotina, and has an acrid taste, whereas that of narcotina is bitter.

PREPARATION OF MORPHIA AND OF ITS SALTS.

The first and principal condition of success in the preparation of morphia consists in the selection of a good sort of opium. Although it may be averred as a general fact that the soft opium of Smyrna is very rich in morphia, yet too much faith should not be reposed in the mere outward appearance of the article. The best and safest way is to ascertain, by actual experiment, the proportion of morphia present in a given sample of opium. This is done most accurately by the ordinary process of extracting morphia. M. Couerbe, however, recommends the following process on account of the greater rapidity of its execution:—

Prepare an infusion (or rather maceration) of the opium in the usual way, add to this lime in excess, and heat for a few seconds; strain; the whole of the morphia will be found in the strained liquid; acidulate the latter, and precipitate with ammonia. You will obtain the morphia almost white, and free from admixture of narcotina.

The following is the ordinary process of preparing morphia:—

Cut a given quantity of opium into small pieces; pour on the latter seven to eight times their weight of cold water, and macerate for 24 hours; malaxate the opium now for the purpose of thoroughly dividing it, and continue the maceration for twenty-four hours longer. Strain, and subject the grounds to the action of the press. Pour on the grounds a fresh quantity of water, and macerate again for two days; strain, and express. Repeat the same operation once more, or even twice, to ensure the extraction of the whole of the soluble parts.

Pour the several liquors together, and evaporate the whole fluid to the consistence of an extract. Redissolve this in cold water. Strain the solution, and evaporate to 5° areom. Saturate with a dilute solution of ammonia (about ten grammes of ammonia per kilogramme of opium used in the process). Remove the precipitate which forms by filtration. Heat the filtrate to ebullition; precipitate the boiling liquid with ammonia added in excess (about 160 grammes of ammonia per kilogramme of opium used), and maintain the fluid in ebullition for eight to ten minutes, to drive off the excess of alkali. The refrigerated liquid should still be slightly ammoniacal.

Collect now the precipitated morphia on a linen filter, and wash it with a jet of cold water. You may concentrate the filtrate and the washings; they will sometimes deposit an additional quantity of morphia on cooling.

Dissolve the morphia in water acidulated with hydrochloric acid; the solution should still retain a very feeble acid reaction. Concentrate the solution to crystallization. Dissolve the crystallized hydrochlorate of morphia in water, and precipitate the alkaloid with ammonia. To obtain the morphia in the crystalline form, place the precipitate in the water-bath of an alembic with alcohol at 88 C. (35° Cartier), and apply a sufficient heat to make the alcohol boil. Keep boiling for about ten minutes, taking care to make use of a condenser, to guard against loss of alcohol. Filter boiling, and, as much as possible, in a close vessel. Subject that portion of the morphia precipitate which remains undissolved repeatedly to the same operation until you have the whole of the soluble matter in alcoholic solution.

The alcoholic liquors deposit a portion of the morphia on cooling. Separate this, and redistil the mother liquor to nine tenths. The residuary fluid will deposit the rest of the morphia on cooling.

Should the divers portions of the morphia differ in their respective degrees of whiteness, redissolve the whole in strong alcohol, to which add some animal charcoal in powder. Filter boiling; the pure and white morphia will crystallize on cooling. The mother liquors will still retain a small portion of the alkaloid, which you may finally obtain by distilling off the alcohol.

M. BECQUEREL ON THE DEVELOPMENT OF ELECTRICITY IN THE ACT OF MUSCULAR CONTRACTION.

I have repeated unsuccessfully the experiment of M. Du Bois Reymond relative to the production of an electric current in the act of muscular contraction, making use of the arrangements which he indicated in a letter addressed to M. Arago by M. de Humboldt, excluding, however, all those secondary causes which could give rise to electric currents, excepting that one the action of which is described.

I shall commence by recalling to mind the observations which I made in studying the electric effects obtained with a condenser, the plates of which were made of platinum or copper gilt ("Traité de l'Electricité et du Magnétisme," t. v., 2e partie, p. 10):—

"The electro-chemical effects produced on the contact of acid solutions with the liquids which moisten the fingers must be taken into account. In these various reactions the acids acquire the positive electricity which is transmitted to the plate, and the liquids which moisten the fingers the negative electricity. With the alkalis the effects are inverse."

It follows from this that, if one of the plates is covered externally by a very thin layer of hygrometric water, and that it is touched with a finger moistened with perspiration, electric effects, resulting from the reaction of the perspiration upon the water, ensue. It is also produced when a finger in a great state of transpiration is applied upon one of the plates, after having been previously moistened with water; in this case the water acquires the positive electricity, and the contrary electricity flows into the body of the experimenter. If we add to these effects those which take place when foreign bodies are adherent to the skin, we must conceive that a large number of complex electric effects would be produced in plunging two fingers, as is done by M. Du Bois Reymond, into two capsules filled with water in which are contained two plates of platinum in communication with a multiplier. This is not all: when, in virtue of these various causes, a current has circulated in the liquid and in the wire, the two plates of platinum are polarized in opposite directions, as may be shown by withdrawing the fingers and establishing the communication between the two capsules by means of a syphon filled with the same liquid as that which they contain. This current, during the first few moments, having the same intensity as the primitive current, annuls it; but if, in the act of contraction, the finger of the contracted hand become more or less immersed in water, the inverse current may be less or superior to the direct current. I guarded not only against the effects of the inverse current, but also against the effects resulting from the greater or less immersion of the fingers, by smearing with fat those parts of the fingers which might temporarily come into contact with the liquid. By proceeding in this manner I found it impossible to observe the effects described by M. Du Bois Reymond.—*Comptes Rendus* for May 28, 1849.

CAP CEMENT.—This is one of the numerous cements which contain wax and resin, and are used for causing adhesion, or making tight joints at common temperatures. Yellow resin, 5 ounces; beeswax, 1 ounce; red ochre, 1 ounce. The latter should be well dried on a sand-bath; the wax and resin melted together; the powder stirred in by degrees; and the heat continued a little above 212°; and, when the frothing has ceased, stir until it is so cold that there is no fear of the earthy particles falling.

STATEMENT IN CONTINUATION OF THAT PUBLISHED IN THE CHEMICAL TIMES OF JUNE 9, 1849, SHOWING THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE AIR FROM JANUARY TO JUNE, 1849, INCLUSIVE, AS INDICATED BY THE EVAPORATION OF WATER FROM TWO COPPER VESSELS OR SCALES, ONE INSULATED AND THE OTHER NOT.—(Vide Page 418.)

Date.	Jan.		Feb.		March.		April.		May.		June.	
	Insulated.	Non-Insulated	Insulated.	Non-Insulated.	Insulated.	Non-Insulated.	Insulated.	Non-Insulated.	Insulated.	Non-Insulated.	Insulated.	Non-Insulated.
1	..	20	..	..	10	..	10	20	..	10	..	10
2	..	..	..	..	20	..	..	25	..	..	5	10
3	..	10	..	..	..	10	..	15	10	..	..	50
4	..	5	5	5	10	..	..	10	..	20	..	10
5	..	5	..	..	..	..	..	35	10	..	..	5
6	..	5	..	..	..	..	..	25	..	20	5	25
7	..	10	..	10	10	..	..	5	..	10	..	60
8	..	10	20	..	40	..	..	25	10	20	..	30
9	10	..	20	..	20	..	..	20	..	15	..	40
10	5	..	..	10	..	..	10	10	..	..	5	20
11	5	..	..	..	..	10	..	..	..	15	..	20
12	15	..	..	20	15	..	..	20	10	25	—	—
13	5	..	..	..	15	5	..	15	..	..	10	25
14	5	..	..	20	5	..	..	35	..	25	..	45
15	10	..	20	..	..	..	..	10	..	15	..	15
16	..	10	..	..	..	..	..	10	..	30	..	15
17	..	..	..	15	..	15	..	10	10	25	10	—
18	10	5	..	10	..	..	..	5	..	25	..	15
19	5	..	5	..	..	30	..	..	10	..	10	—
20	..	..	..	10	..	20	..	..	*	*	..	10
21	5	..	10	5	..	..	..	10	*	*	5	—
22	10	..	25	..	..	20	..	30	..	75	5	20
23	25	..	..	..	10	10	..	5	..	25	..	5
24	..	5	..	..	..	..	..	25	..	40	*	*
25	25	..	..	..	..	20	..	10	..	45	..	100
26	10	..	10	10	10	..	..	35	..	50	10	—
27	..	..	..	30	..	30	..	10	..	80	*	*
28	10	..	10	10	..	..	..	15	..	10	*	*
29	10	5	..	..	..	30	..	30	..	25	*	*
30	5	..	..	..	10	..	..	50	..	50	..	110
31	..	..	..	..	..	..	..	..	..	40	..	20
Grs.	170	90	125	155	175	200	20	515	60	695	65	660
	29.85		30.24		30.01		29.61		29.89		29.99	Average of barometer, read at nine o'clock morning.
	40°		43°		44°		46°		56°		61°	Average of thermometer, read at nine o'clock morning.
	19 oz.		20 oz.		18 oz.		28 oz.		32 oz.		52 oz.	Total evaporation from both scales.
	16		8		9		22		11		5	Number of days on which it rained.

REMARKS.

The *differences* are doubtless governed by the total amount of evaporation from both scales; and when it shall please the authorities and the scientific world so far to notice my labours as to condescend to an inquiry, and to add these scales to the other instruments of research, the daily amount of evaporation may readily be determined.

In the remarks appended to my tables of September, 1847, I observed :—" A comparison of this table with that published in June last cannot fail in throwing much light on the cause of the potato disease, assuming that the nitrogen liberated from the air by combustion and respiration is converted into ammonia, as stated in my former papers. It has long been determined by naturalists that plants thrive luxuriantly in water that is positively electrified, but do not grow in water negatively electrified. And it is now admitted as a fact that the earth and the atmosphere are in opposite electricl conditions, and I think it will be allowed as equally unquestionable that electricity is the cause of evaporation, and that all nitrogenous matter is prone to putrefaction. Assuming the nitrogen liberated in England by combustion, &c., to be one third of that disengaged in Europe and America, there must be generated annually about twelve hundred million tons of ammonia, sufficient, it is presumed, to exercise an influence on the vegetable kingdom. The potato disease commenced in August, 1845, showed itself in all its virulence in July, 1846, and again reappeared in June last, but is now gone, and fevers are prevalent. Of the electrical condition of the earth in the middle of 1845 we have no positive evidence; but there having been a frost in the middle of August it may be assumed that the electrical condition of the air was high, and, therefore, that of the earth low. In 1846 that of the atmosphere was unquestionably high, whilst this year it is, comparatively speaking, low, althnugh in June, when the potato disease again appeared, it was higher than in Juue, 1846, affording evidence, at least worthy of consideration, that the potato disease is referable to the combined influence of ammonia and the low electrical condition of the earth."

This year the electrical condition of the earth is remarkably high, and that of the air low, compared with the preceding years, and we have cholera, a cold complaint, and a most abundant harvest; a heavy fall of rain, however, bringing down with it its corresponding proportion of ammonia, may produce the potato disease, notwithstanding the high elcctrical condition of the earth.

I have no doubt but that the potato, unless it change in constitution, will ultimately fall a victim to the increased consumption of coal throughout the world. The quantity in this country alone has now reached *thirty-five million tons* annually, and the application of steam is rapidly on the increase.

On the days marked * I was absent from town; the numbers immediately following, therefore, represent the balance only of the differences. When the authorities shall be roused out of their slumbers, or are made sensible of the necessity for inquiry, these omissions will not have to be lamented.

STATEMENT SHOWING HOW THE AMOUNT OF DIFFERENCES IN THE ABOVE TABLE ARE MADE UP FOR THE MONTH OF MAY, 1849, THE ELECTRICAL CONDITIONS GIVEN AT THE ROYAL OBSERVATORY FOR THE SAME PERIOD BEING ATTACHED.

Date.	Morning.	Eveniug.	Insulated.	Non-Insulated.	ROYAL OBSERVATORY.
1	10 N.	..	..	10	Positive and tension strong at 9 P.M.; nil at other times.
2	..	..	..	..	Nothing was shown throughout the day.
3	10 I.	..	10	..	Positive and tension strong at noon, and from 9 P.M. till midnight; nil at other times.
4	10 N.	10 N.	..	20	At 9 A.M. nil; positive and tension strong at other times.
5	10 I.	..	10	..	Positive and tension strong between 2 and 3 P.M.; nil at other times.
6	..	20 N.	..	20	
7	..	10 N.	..	10	
8	20 N.	10 I.	10	20	
9	10 N.	5 N.	..	15	No electricity has been shown throughout the week at the times of examination of the instruments.
10	..	..	..	..	
11	10 N.	5 N.	..	15	
12	10 I.	25 N.	10	25	
13	..	..	..	..	
14	15 N.	10 N.	..	25	
15	5 N.	10 N.	..	15	
16	10 N.	20 N.	..	30	No electricity has been shown throughout the week, with the exception of Friday, the 18th, during a squall of wind and rain, when negative electricity was exhibited, with strong tension.
17	10 I.	25 N.	10	25	
18	15 N.	10 N.	..	25	
19	10 I.	..	10	..	
20	*	*	*	*	
21	*	*	*	*	
22	*	75 N.	..	75	
23	..	25 N.	..	25	May 24, 0.h., positive, with strong tension. Nothing was shown at any other examination throughout the week.
24	..	40 N.	..	40	
25	15 N.	30 N.	..	45	
26	20 N.	30 N.	..	50	
27	15 N.	65 N.	..	80	
28	..	10 N.	..	10	
29	5 N.	20 N.	..	25	Negative electricity, with strong tension, was exhibited on Monday during heavy rain. Nothing has been exhibited at other times on the other days.
30	10 N.	40 N.	..	50	
31	10 N.	30 N.	..	40	

N.B. The "morning" register shows the evaporation of the night, the "evening" that of the day.

Westminster-road, July 2, 1849.

Franklin Coxworthy, Author of "Electrical Condition," &c.

ORIGINAL COMMUNICATIONS TRANSLATIONS, ETC.

ON THE INORGANIC CONSTITUENTS OF ORGANIC BODIES.

By H. ROSE,

*Professor of Chemistry in the University of Berlin.**

The inorganic constituents of vegetable and animal substances have received more attention during the last few years than was formerly the case; and in consequence of Liebig's exertions especially numerous investigations of the ashes of organic substances have been made; but their principal object was only technical. It was soon perceived that, as plants derive the inorganic constituents, without which they cannot exist, from the soil, it was of the greatest importance to determine these constituents with accuracy, so as to be enabled to judge whether the soil was capable of yielding them; and, if not so, to allow of their being added in the form of a suitable manure.

Hitherto almost all these investigations have been directed to the determination of the relative proportions of the inorganic constituents of the ash. Occasionally, indeed, the presence of certain inorganic constituents, especially salts, has been detected by microscopic examinations; but scarcely any one has expressly taken up the question which is somewhat closely connected with this point, viz., in what manner are the inorganic substances combined with the organic? Whether they form with each each other the same kinds of combinations as those which are artificially prepared in our laboratories, or whether peculiar compounds, existing only in living organic bodies, are formed by the mutual influence of the inorganic upon the organic matters, are questions which must be of great importance, especially in animal and vegetable physiology, and which have not hitherto been ac urately investigated.

In very few instances only have researches of this kind been attempted. Endeavours have been made, for instance, to show the manner in which the iron is combined with the other constituents of the blood. But these and some other experiments of the same kind form isolated examples; at least it has never been attempted to ascertain the changes which the inorganic constituents supplied to vegetable and animal bodies by the soil and articles of food undergo within them.

Some time since I endeavoured to prove that when an organic substance of vegetable or animal origin is carbonized with exclusion of the air, by not too great a heat, the inorganic constituents can partly be extracted by the ordinary solvents of inorganic salts—water and muriatic acid—but that a portion, and this frequently the largest, exists in the carbonized residue of some organic substances in such a state as completely to resist the solvent action of water and muriatic acid, and can only be obtained by burning the carbonized mass in oxygen gas or in atmospheric air. This portion of the inorganic matters undoubtedly does not exist in the organic substance in the state in which it is obtained after the incineration, nor even in the carbonized mass obtained from it, but it has been formed by oxidation. I also described several experiments which showed that the presence and the nature of the carbonized mass could not be the causes of the insolubility of the inorganic substances in the solvents, even if they pre-existed in the organic bodies in the same state as that in which we find them in the ash.

These remarks, which I published in an imperfect state and supported by few proofs, for the sake of directing the attention of chemists to this, as it appeared to me, not unimportant subject, have not received any attention. Since that time I have, however, occupied myself with these investigations, and have induced several young chemists in my laboratory to determine the inorganic constituents, with a view to separating those which exist already formed in organic bodies from those which must be contained in them in an unoxidized or less oxidized state.

These investigations have completely confirmed the view I had arrived at from reflecting upon this subject. In fact, I may assert that in none of my chemical investigations has experiment so completely confirmed the hypotheses which I had made before the commencement of the undertaking than in these.

When we minutely trace the entire process by which plants and animals assimilate the inorganic substances consumed, it appears that this is effected in the two cases in an entirely opposite manner. I shall now investigate this more minutely.

THE INORGANIC CONSTITUENTS OF PLANTS.

Plants obtain their inorganic constituents by means of the roots, which derive them from the soil upon which they grow. The latter either already contains them among its constituents, or they are added to it in a suitable manure. In both cases these inorganic constituents exist in the highest possible state of oxidation. If they are not contained in the manure in this state, the latter is not in a perfectly proper condition, and does not become so until it has been exposed to the air for some time.

It may certainly be admitted that the inorganic constituents, absorbed by the root in the most perfect state of solution possible, ascend in the vessels of the stem. Probably those salts which are insoluble in water are dissolved by the aid of carbonic acid.

During the growth of the plant a deoxidizing process goes on within it; the green parts under the influence of solar light, as is well known, evolve oxygen gas. Even when they only decompose the carbonic acid of the air, they assimilate its carbon; hence the amount of the latter in the plant gradually increases in proportion to that of the oxygen. All those parts of the plant which are in contact with the green parts take a share in this deoxidizing process, so long as it continues in a state of growth and the green parts have not lost their green colour. Now, when we find that in plants one portion of the inorganic constituents absorbed by the root exists in a deoxidized state, in which, at least after the carbonization of the plant, it is insoluble in the ordinary solvents—water and muriatic acid—and that this portion is not converted into the same salts as those absorbed by the root from the soil until after oxidation, it may be supposed that the quantity of deoxidized inorganic constituents must be small in those parts of the plant which are in more immediate contact with the soil, and in which, therefore, the deoxidation of the parts of the plant, and also that of the inorganic salts existing in them, first commenced. But this quantity must be greater in those parts of the plant the formation of which has required the longest time; and after the formation of which many plants, including all the annuals, die. Hence the proportion of the inorganic constituents of the plants which are deoxidized to that of those which are not deoxidized must be very different in the herbaceous portions of the plant and the seeds.

This supposition has been most completely verified by experiment.

M. Weber made a comparative experiment upon the inorganic constituents of peas and pea-straw. They were both carbonized, with exclusion of the air, at such a temperature that the water with which the carbonized mass was treated was not coloured yellow or brown, but remained perfectly colourless. Water extracted from the carbonized mass of the peas a large amount of chloride of potassium and phosphate of potash, some chloride of sodium and sulphate of potash, and a considerable quantity of carbonate of potash: the latter must have been contained in the peas, before carbonization, in the form of the potash-salt of an organic acid. Water extracted from the carbonized mass of the pea-straw a far larger amount of carbonate of potash, but smaller quantities of chloride of potassium, chloride of sodium, sulphate of potash, silicate of potash, and sulphate of lime.

When the carbonized mass, which had been exhausted with water, was then treated with muriatic acid, the latter dissolved out of the carbonized peas phosphate of soda, potash, lime, magnesia, and perphosphate of iron, but no earthy carbonates; whilst from the carbonized pea-straw this acid extracted a large quantity of carbonate of lime, a small quantity of carbonate of magnesia, and the phosphates of lime, magnesia, and iron, but none of potash or soda.

The carbonized mass which had been exhausted with water and muriatic acid was burnt with access of air. The ash of the peas consisted of the phosphates of potash, lime, magnesia, and iron; that of the pea-straw was composed of the phosphates of magnesia, lime, and iron; it contained no potash, but a considerable quantity of silica.

On comparing the amounts of inorganic matters obtained from the peas and the pea-straw by these two operations, the following results are obtained. 100 grms. of peas and 100 grms. of pea-straw yielded—

	Peas.	Pea-straw.
Exhausted by water	0.380	1.417 grm.
Exhausted by muriatic acid	0.356	3.458 grms.
On the incineration of the carbonized mass..	0.909	0.375 grm.

Hence water and muriatic acid dissolved very considerable quantities of inorganic constituents from the carbonized pea-straw, but not more than a sixth or seventh of this amount from the peas; whilst on the incineration of the carbonized mass which had been exhausted by solvents far more fixed salts were formed in the case of the peas than in that of the pea-straw.

The proportion in the latter case is, however, far more remarkable than is at first sight apparent; for the ash of the exhausted carbonized mass of the pea-straw contains more than half its weight of silica, which existed as such in the oxidized state in the living plant, and could not be obtained until after the incineration of the carbonized mass, merely in consequence of its insolubility in the solvents. If we take this circumstance into account, the exhausted carbonized mass of the peas yields five times as large an amount of fixed salts as that of the pea-straw.

Exactly the same results were obtained in the analysis of the inorganic constituents of rape and rape-straw made by M. Weber.

The quantities per cent. of inorganic constituents were—

	Rape.	Rape-straw.
Extracted by water	0.230	1.556
Extracted by muriatic acid	0.884	1.805
On the incineration of the carbonized mass.....	1.364	0.570

Here also the proportion is more striking than appears at first sight, because nearly half of the ash of the carbonized mass of the rape-straw after exhaustion with the solvents consists of silica, as in the case of the pea-straw.

The salts obtained by the incineration of the carbonized mass after exhaustion by the solvents could not have existed as such in the plants and seeds, as has been already mentioned, nor even in the carbonized mass itself, but must have been produced by oxidation. The next question then is, in what states of combination did the unoxidized inorganic constituents exist in the plant, and what in the carbonized mass obtained from it? Upon this point all our explanations are insufficient; and this question can only be answered by hypothesis, which cannot be verified without further investigations. But at all events the subject forms a wide field for interesting investigations, which lead to important results, and by which both chemistry and physiology may acquire important elucidation.

The carbonized residue of peas and rape, after exhaustion with water and muriatic acid, yields on incineration a large amount of phosphates,

* From Poggendorff's "Annalen," vol. lxxvi., p. 305, and "Phil. Mag."

and which, had they existed as such in the carbonized vegetable matter, would have been dissolved by the water and muriatic acid. The carbonized mass also contains considerable quantities of nitrogen. If the phosphorus existed in the unoxidized state, it is most probable that it formed compound radicals with carbon and nitrogen, similar to cyanogen or sulphocyanogen, which were combined with the metals of the basic oxides contained in the ash. Hence, in proportion as the deoxidizing process proceeds in the living plant, the phosphates which are absorbed from the soil by the roots become converted into non-oxidized compounds, consisting of compound radicals containing phosphorus and the metals of the alkalis and earth. These must exist in the largest quantity in those parts of the plants which are composed of substances exposed for the greatest length of time to the deoxidizing process; and these are evidently the seeds of the plants, which are formed latest, and upon the production of which the life of many plants entirely ceases.

Thus the phosphates are decomposed in plants by the deoxidizing process in the same manner as the sulphates are converted into sulphurets by deoxidation. Probably the more appropriate explanation is, that, when substances containing nitrogen and carbon are present, sulphocyanurets, or compounds of a radical consisting of three elements, sulphur, carbon, and nitrogen, may be formed from the sulphates by a deoxidizing process.

If we admit the occurrence of these compounds of hypothetical radicals with metals in the seeds of plants, the next point, after the determination of their properties, would be the investigation of their relation to the great mass of the organic matter in those parts of the plants in which they exist. But, as even the existence of these compounds is problematical, it would be useless to form further hypotheses on this point before making ourselves somewhat more intimately acquainted with these compounds themselves.

The so-called proteine compounds appear to be formed principally in plants by the process of deoxidation; and it is precisely these substances which appear to combine with the radicals containing phosphorus, in combination with metals.

Another question must be proposed here, although it cannot be satisfactorily answered. Supposing that these compounds really exist in certain parts of plants, what changes do they undergo when the plant is carbonized with exclusion of air; when, consequently, all the organic matter is destroyed, and the connection in which they probably stood to these compounds is dissolved. So long as we have no certain knowledge of the existence of these compounds, we cannot judge with certainty of the changes which they experience at an elevated temperature. It is, however, possible, at least not improbable, that they may be acted upon, at an elevated but not too high a temperature, in the same manner as the cyanurets, when they are transformed by heat into paracyanurets. Be this as it may, the experiments show that these compounds after carbonization are insoluble both in water and in muriatic acid. But this insolubility in the solvents did not always exist before carbonization; for many organic substances, which in an undecomposed and not carbonized state are soluble in water, frequently contain a large part of their inorganic constituents in an unoxidized state.

It is well known that most of, but not all, those inorganic salts which are insoluble in water are soluble in muriatic acid. But those salts which are insoluble in this acid certainly very rarely occur in vegetable and animal substances. The metaphosphates require most attention in this respect, since they may exist in the carbonized substance; and yet, on account of their insolubility in water and muriatic acid, their presence may only be detected after the destruction of the carbonized mass. But it is evident, from the investigations which have been made upon the inorganic constituents of vegetable and animal substances, that these metaphosphates can rarely if ever be present, since in most cases carbonate of potash may be removed from the carbonized mass by water, and which, as is well known, cannot exist simultaneously with metaphosphates at an elevated temperature.

We must next mention the remarkable occurrence of silica in vegetables, principally in the stems of the grasses and equisetaceæ. The silica is undoubtedly removed from the soil by the plants in the form of silicate. It becomes separated, however, from this silicate; and the silica separated forms the principal mass of the stem in several species of equisetum and the grasses. Of course it exists in them in the form of perfectly oxidized silicic acid; but, in consequence of its insolubility in water and muriatic acid, the greater part of it is found in the mass remaining after the exhaustion of the carbonized substance with water and acid.

Hence on comparing the quantities of the inorganic substances which the seeds and the culm of grasses yield in the aqueous and muriatic solutions of the carbonized substance, and on the combustion of the latter, we find, in contradiction to the above determination, that the carbonized straw yields far more fixed substances than the seeds. But this contradiction is only apparent, because the substances obtained after the incineration of the carbonized straw consist almost entirely of silicic acid.

A comparative examination of the inorganic constituents of wheat and wheat-straw made by M. Weber proves this beyond a doubt.

Water extracted chloride of sodium and phosphate of potash and soda from the carbonized grains of wheat, but no carbonates; whilst from the carbonized wheat-straw it removed chloride of potassium, chloride of sodium, some sulphate of potash, and no phosphates, but a remarkably large amount of silica. Muriatic acid subsequently dissolved only compounds of phosphoric acid with potash, soda, lime, magnesia, and peroxide of iron. From the carbonized straw muriatic acid extracted combinations of phosphoric acid with lime, magnesia, and peroxide of iron, as also some silica.

The carbonized grains of wheat, after exhaustion by the solvents, yielded on combustion compounds of phosphoric acid with potash, lime, magnesia, and peroxide of iron; also some silica. The solids remaining after the combustion of the carbonized wheat-straw consisted almost entirely of silica, with extremely small quantities of the phosphates of lime, magnesia, and peroxide of iron.

On comparing the amounts of the constituents obtained in the different operations we obtain the following results. 100 grms. of the grains of wheat and of the straw yielded—

	Grains of Wheat.	Wheat-straw.
In the aqueous solution .	0.471 grm.	1.216 grm.
In the muriatic solution.	0.562 "	0.474 "
On the incineration of the carbonized mass	0.246 "	2.135 "

Of the 2.135 grms. of fixed constituents which the carbonized wheat-straw yielded, 2.022 grms. consisted of silica, and only 0.113 grm. of phosphates. When this is taken into consideration this investigation also proves that the quantity of so-called deoxidized inorganic constituents in the grains of wheat is greater than that in the wheat-straw.

[*To be continued.*]

ON THE PREPARATION OF VITRIFIABLE PIGMENTS FOR PAINTING UPON PORCELAIN.

By M. H. BOHLEN.

The observations recently communicated by M. Wächter on vitrifiable pigments* have induced the author to publish his experience on this subject.

Gold Purple is obtained, according to the process of Lüdersdorf, by mixing a solution of 1 part ducat gold in 4 parts aqua regia, with 1 drm. of tin salt dissolved in 4 oz. distilled water, and a solution of 1 drm. of gum in 3 oz. of water in the following proportions:—

Distilled water	3 oz.
Solution of gum arabic.....	28 grs.
Solution of tin salt	14 "
Solution of gold.....	23 "

and adding alcohol of 0.863 spec. grav. until the liquid begins to grow turbid. The purple is deposited and washed with spirit of 0.958. The dried precipitate has a brownish colour, and furnishes, when all the gum has been carefully removed by washing, a very beautiful purple after the firing.

According to Fuchs, 1 oz. liq. ferri muriat. oxydati, Ph. bor., is mixed with 3 oz. of distilled water and a solution of 1 oz. protochloride of tin in 6 oz. distilled water, and 10 drops of muriatic acid added until the whole has acquired a greenish colour, when a further addition of 16 oz. of distilled water is made.

On the other hand, some ducat gold is heated to boiling with pure nitric acid until all the gold is dissolved. An excess of acid should be avoided. 360 parts of distilled water are added to this solution of gold; and then the above solution of iron and tin gradually poured into it until the whole of the purple is precipitated. This precipitate has likewise a brownish tint after drying, but furnishes a beautiful purple after burning.

The author finds, however, that gold purple prepared according to the following process is preferable, especially as regards the external appearance:—A mixture of 4 parts pure nitric acid of 1.24 spec. grav., and 1 part pure muriatic acid which is mixed with half as much pure alcohol of 0.863, and chemically pure tin gradually added in small portions until no more is dissolved; the solution must be effected slowly, on which account the vessel containing the mixture should be placed in snow or cold water. The carefully-decanted solution is diluted with eighty times its weight of distilled water, and mixed with a solution of gold prepared according to the above directions. The precipitate is purple-red, and remains so after drying. The tin solution for this purpose cannot be preserved long, otherwise nitric ether is formed; and the higher oxidation of the tin salt no longer furnishes such beautiful precipitates with gold as the recently-prepared solution.

For mixing with the purple in order to produce a rose colour, the author does not employ carbonate of silver, but the metal in a very minute state of division obtained by mixing the finest silver leaf with honey and a few drops of ether, and well grinding it, when the honey is washed out with water. The author uses as a flux for the purple colours a lead glass consisting of 6 parts minium, 2 parts silica, and 2 parts of calcined borax.

With respect to the chrome colours, the author observes that the expensive method for their preparation by means of the chromate of the protoxide of mercury is still the only one by means of which a fine colour can be obtained.

Cobalt Colours.—In purifying the cobalt for porcelain colours the removal of the whole of the arsenic is of less consequence than that of the iron. Cobalt ores from various localities, Tunaberg, Saxony, and Thuringia, are treated in the following manner:—The mineral is reduced to a fine powder in an iron mortar kept for the purpose, and mixed with one fifth its weight of charcoal powder; then exposed in Hessian crucibles to a red heat under a chimney with a good draught, or in the open air, and roasted as long as arsenical vapours escape—a very disagreeable operation which lasts several hours. The ore thus prepared is now boiled over the fire with a mixture of 4 parts nitric and 1 part muriatic acids, 1 part of which is diluted with 3 parts of water. This operation is repeated about three times with less acid. The liquids are allowed to settle, the clear portion decanted, the remainder diluted with water and filtered, and the solution

* See vol. iv., pp. 190, 202, 230, and 287.

evaporated to dryness. The dry mass is mixed with some water, heated, and separated by filtration from the residue of arseniate of iron. The green liquid, which now contains more or less cobalt, iron, nickel, and manganese, is mixed with a filtered solution of pearlash until the dirty-reddish precipitate begins to turn blue. Care and experience in this operation are requisite, otherwise a loss of cobalt might result. The precipitate of arseniate and carbonate of iron, which at the same time contains nickel and manganese, is separated by filtration, and the beautiful red liquid mixed with more of the solution of pearlash until the whole of the cobalt is precipitated; the precipitate is carefully washed and dried. This hydrated oxide of cobalt is sufficiently pure for technical purposes, and answers just as well as that prepared from oxalate of cobalt or by caustic ammonia.

For painting, the oxide of cobalt is heated in a Hessian crucible with 1 part silica and $1\frac{1}{2}$ part oxide of zinc for two hours in a blast furnace, then reduced to a fine powder in a porcelain mortar, and mixed with an equal weight of lead glass.

Yellow Colours.—A beautiful yellow is obtained from 2 oz. minium, $\frac{1}{2}$ oz. Stib. oxydat. alb. abl., 2 drms. oxide of zinc, 2 drms. 2 scruples calcined borax, $\frac{1}{2}$ oz. silica, $\frac{1}{2}$ drm. dry carbonate of soda, and 1 scruple ferr. oxydat. fuscum, which are well mixed, fused in a crucible, and then ground fine.—*Archiv der Pharm.*, lvii., p. 276.

ON THE INTRODUCTION OF THE NATURAL SCIENCES INTO GENERAL EDUCATION.

By J. WILDSMITH, Esq.

At a meeting held, June 18, at the General and Scientific Training School, Haddesdon, for the annual distribution of prizes, Mr. Wildsmith, of London, delivered a lecture "On the Introduction of the Natural Sciences into General Education."

The lecturer, who was listened to throughout with great attention, said he believed this institution was the first to introduce practical science into general education, which was a step in the right direction; for thereby the intellectual faculties of the pupils were strengthened and developed, and their minds were stored with the principles of scientific truth, so as to fit them for discharging the duties of any sphere of action. If a man were not trained to investigate the laws and phenomena of nature, and did not possess the knowledge and means to qualify him to do so, he would be unable to make a single discovery, to elucidate a single scientific truth, to apply a single principle to the advancement of his own comforts and happiness, or those of his fellow-creatures, or to raise himself to any degree of eminence in the scale of society. Chemistry and its kindred sciences were essential in every system of education. No branch of human knowledge was so useful and extensive, and tended so much to awaken and interest the mind, as chemistry. The prosperity of nations and of individuals had increased as improvements and discoveries in this science had been made. It teaches us the nature and composition of all material substances, and the elements of which they are compounded. To the discoveries of chemical science we are indebted for improvement in arts and manufactures, and for every addition to the means of promoting health and multiplying our comforts and luxuries. How important and indispensable, then, must be a knowledge of the facts and principles which effect so much good for society. To exclude them from any system or course of education was to negative the progress of the human mind, and shut out all that is great, good, and ennobling. Chemistry lends her aid to other sciences. She teaches the geologist the nature and composition of the various strata of the earth and rocks, and the nature of the elements which compose them, and enables him to trace the probable origin and true cause of their formation. She teaches the astronomer the nature and combinations of metals, and thus enables him to form more perfect and more powerful instruments, so that he may scan the boundless regions of space, and have revealed to his astonished mind innumerable worlds suspended by the arm of the omnipotent Creator. Chemistry, too, has made known the true nature of respiration, digestion, assimilation, the source of animal heat, and all the phenomena connected with organic life. Through the chemist, the physician is enabled to obtain new and powerful remedies, and in some instances cures of the most awful maladies which afflict humanity, make life burdensome, and death a blessing. In the works of natural philosophers, the chemist, the physician, the physiologist, the geologist, the astronomer, and the mechanician, during the past half century, we see what stupendous results have arisen from the application of chemical science. The perfection of the locomotive steam-engine—fleeter than the fleetest horse—and the improvements in the means of artificial lighting, mining, glass-making, dyeing, bleaching—which aided the cause of civilization, promoted the spread of human happiness and the luxuries of life—were all indebted to the aid of chemical science. Strange to say, however, there was one branch of human industry, though the most interesting and important—the science of agriculture — which had remained comparatively stationary; but to this public attention was beginning to be awakened, especially with regard to the application of chemical science. From such an application great and permanent good must soon come. The farmer must learn the nature and constitution of his soils; he must ascertain what ingredients are required as food by the plant he wishes to cultivate on them; and this would include a knowledge of the nature and constitution of each separate class of plants, as well as the soil. He (the lecturer) did not think the time had arrived when the farmer could receive at the hands of any individual or individuals the means of at once accomplishing the desired result, that of increasing the crops. The application of the boasted means of good must be at least guided by scientific principles, by a knowledge of what was and what was not wanted, and of the time and manner of applying the means. Abundance and success would not crown the farmer's labours until he applied himself to the study of the scientific principles of his calling; the young at least must be so trained. The lecturer then proceeded to elucidate some few of the phenomena of life revealed to us by chemical science, and contended that the introduction of the sciences into general education was not merely essential, but absolutely requisite to the intellectual training of rising farmers, and was the only means of securing success in after life. He pointed out the relation of soil to plants, and plants to animals, and the phenomena of respiration, assimilation, germination, and combination, and demonstrated his remarks by a series of beautiful and instructive experiments, which clearly illustrated the bearing of the important phenomena referred to. The lecture was closed by some few experiments showing the general application of the sciences to the arts and manufactures.

THE CHEMICAL TIMES.

SATURDAY, JULY 7, 1849.

MR. COXWORTHY'S THEORIES ON ELECTRIC CONDITION, &c.

In our number of June 16 we stated that we intended shortly to examine the novel and startling views and theories propounded by Mr. Coxworthy on electricity in general, and on electric condition in connection with heat, crystallization, meteorology, evaporation, magnetic condition of the earth, gravitation, chemical affinity, &c. &c., and to discuss their scientific value, particularly in reference to cholera and other epidemic and periodical diseases.

There is, however, a vast amount of obstruction to be cleared away before we can satisfactorily enter upon the performance of this important task in a manner to produce effect upon the medical world. First and foremost, the principles to which we shall have occasion to make reference are inseparably connected with the physical sciences, and these sciences continue still too much involved in mystery and obscurity to afford any thing like a safe basis whereon to rest a theory or system that might lead to a satisfactory explanation and ultimate comprehension of the phenomena of the physical world. The difficulty which we have to contend against here derives still additional weight from the fact that these sciences, instead of being looked upon and treated as constituting an inseparable whole, have hitherto been considered as distinct and separate branches of study; and in many cases the investigation that has been allotted to one particular branch appears to appertain more properly to some other branch.

In illustration of this position we may remark that meteorological investigations, for instance, have been assigned hitherto to the mathematician; and, with a view to facilitate his investigations, observatories have been erected, at an enormous expense to this country, in different parts of the globe.* To the mathematician, then, has been assigned the task of determining, by means of certain instruments—whether suited to the purpose or not we will not now stop to inquire—the dew point, the amount of vapour in the atmosphere, and sundry other points that come within the range of mathematical calculation; and, on reference to the works that have been published—also at the public expense—it will be seen that most diligently and unremittingly has he discharged this duty; but it will be seen also that the actual constitution of the atmosphere itself has never engaged his attention; upon this point he had received no instructions, and accordingly felt in no way concerned in it; nor would it appear that this most important branch of investigation has been assigned to the care of any one else.

The chemist has long since ascertained that the atmosphere is a compound (?) (or mixture?) of one proportion of oxygen to four of nitrogen, and that during the processes of combustion and respiration oxygen is abstracted from it; and, on reference to the remarks appended to Mr. Coxworthy's electrical statement up to the end of last month (which will be found in another part of this number), it will be seen that there is annually consumed in this countr alone the enormous quantity of thirty-five million tons of coal, which, taking the coal as pure carbon, must abstract from the atmosphere ninety-five million tons of oxygen, and liberate, at the same time, the amazing bulk of 380 million tons of nitrogen gas—a fact that was utterly disregarded until noticed by Mr. Coxworthy.

* This was done, we believe, on the recommendation of the British Association.

We do not pretend to assert that this action of the processes of combustion and respiration produces any absolute effect on the electric condition of the atmosphere; but if it be considered that, assuming the amount of coal consumed in other portions of the globe to be equal only to the consumption of that element in this country, and allowing about thirty million tons more for the wood, turf, peat, &c., annually burned, we arrive at a gross total of 100 million tons of fuel consumed per annum at the expense of 270 million tons of atmospheric oxygen, with attendant liberation of 1,080 million tons of nitrogen, it must appear self-evident to any one that this enormous loss of oxygen, conjointly with the liberation of such an amazing bulk of nitrogen, would speedily exert a very perceptible influence highly detrimental to both the animal and vegetable kingdoms, were it not for certain means provided by nature for the constant regeneration of the atmosphere. But can it be said that the doctrines and views at present entertained on the subject afford anything like a satisfactory explanation of the nature and character of those means, more especially now that so much light has been thrown on the electric condition of the air?

We purpose returning to this highly interesting inquiry. For the present we request the attention of our readers to the valuable information contained in Mr. Coxworthy's table, affording as it does—when compared with the one published in our number of the 9th ultimo—unquestionable evidence that there exists alternately in the earth and the air some condition that exercises a most powerful influence on the animal and vegetable kingdoms. It is, indeed, deeply to be regretted that a similar register to Mr. Coxworthy's was not kept at Paris during the prevalence of the cholera. The indications of such a register would have afforded most valuable information to us at the present juncture, when that dire scourge is again in the ascendant in our metropolis.

We trust that the Board of Health will pay in future some more attention to this most vital question than appears to have been done hitherto. To persist in refusing a full investigation of Mr. Coxworthy's views, and of the sanitary suggestions based thereon, in the face of the facts and figures adduced by that gentleman, would be a most censurable neglect on the part of the authorities concerned.

We hope that this object will meet speedily with the attention due to its immense importance in a sanitary point of view. In the mean time we shall continue to publish weekly the indications shown and results afforded by Mr. Coxworthy's electric apparatus.

GUTTA PERCHA TUBING.

The extraordinary properties possessed by this tubing render it valuable for many chemical purposes. It is unaffected by any of the acids, excepting only the strongest oil of vitriol and nitric acid. The cold fixed oils, grease, alkalis, &c., have no action upon it; its strength is remarkable. The Birmingham Water Works Company have just made a series of experiments for the purpose of testing the pressure it will bear, with a view to ascertain its applicability for the conveyance of water. A tube of three quarters of an inch in diameter, and one eighth thick of material, was attached to the iron main where there was a fall of 200 feet head of water. It was afterwards attached to the hydraulic proofing-pump, and subjected to a pressure of 337 lbs. on the square inch. Notwithstanding these severe tests the tube remained uninjured. It is important to chemists to know that it does not collapse like indiarubber, and can, therefore, be used for syphons. Being a non-conductor, it is not affected by frost, like metals. The ease with which the joints are made, by simply warming the flanges with a heated iron, is no small desideratum, although the extraordinary lengths in which the smaller tubes can be made (100 to 400 feet) avoid the necessity of even a single joint for the generality of chemical purposes.

PROCEEDINGS OF LEARNED SOCIETIES.

[From the *Pharmaceutical Journal.*]

THE PHARMACEUTICAL SOCIETY.

At the meeting of June 13 the following papers were read:—

"On the Purgative Properties of Oil of Anda," by Alexander Ure, Esq., Fellow of the Royal College of Surgeons of England, and Surgeon to the Westminster General Dispensary.—I was requested some months back by your Professor of Pharmacy and Chemistry, Mr. Redwood, to investigate the therapeutic properties of an oil expressed from seeds imported from the Brazils, and which seeds are much used by the natives of that country as a cathartic, in doses of from one to three. The plant which yields it is the Anda Gomesii, so named after Gomes, who described it, although a previous description had been given by Piso. It belongs to the natural order of Euphorbiaceæ, and to that of Monæcia Monadelphia in the sexual system. In referring to the "American Cyclopedia of Practical Medicine and Surgery" (vol. i., Philadelphia, 1834) we learn that "the part used in medicine is the fruit, which is about the size of an apple, and of an ash-colour. On removing the external husk a nut is presented to view, which is about two inches in diameter. It has a hard shell, which, on being broken, exhibits two cells, each containing one seed about the size of a chestnut." * * * "By expression these seeds furnish a clear, pale, yellowish oil, which is destitute of taste, and almost of smell; at common temperatures as fluid as olive oil." From experiments made in the Pennsylvania Hospital, by Dr. Norris, it appears that in doses of fifty drops it generally induced one evacuation, and in larger quantities operated copiously.

The oil employed by me, kindly supplied by Mr. Ince, of the house of Godfrey and Cooke, had a specific gravity of .927, and corresponded in sensible properties to the above description. I found, however, a smaller dose suffice to produce a purgative effect than that stated on the authority of Dr. Norris. I believe, indeed, that many purgative remedies in small doses increase the peristaltic motion, and thus ensure evacuation, which in larger doses would occasion only colic pains and costiveness. This fact is based on the physiological principle, that slight stimulants are more efficient than those of a violent character in awakening sympathetic action.

I now adduce short abstracts of some cases in which this oil was tried:—

D. H., aged twenty years, came under my care for scrofulous disease of the hand. Had been troubled with constipation of the bowels since infancy; having an alvine discharge, upon an average, once in three days; the evacuations being hard and scybalous. He was directed to take, upon the 11th of October, 1848, twenty drops of the oil of anda every morning on a lump of sugar. On the 18th he informed me that the first dose operated freely as an aperient, the second dose on the following day, and the third dose also, but seemed to occasion some nausea. This man was of a marked scrofulous habit, and most probably owed the nausea to some coincident irritability of stomach.

A. H., aged nineteen years, of spare make and sedentary habits, was admitted under me on the 27th of November, 1848, for an eruption on the skin. She complained of headache, uneasiness of the chest; her bowels were so constipated as to be partially unloaded but once in three days; her tongue was white, and she felt feverish. She was ordered saline effervescent draughts, and twenty drops of oil of anda every morning on a piece of sugar. On the 11th of December it was reported that each dose operated thrice. She recovered, and, by taking ten drops for a few successive mornings, succeeded in getting her bowels to act once daily.

R. J., aged thirty years, a powerful muscular man, came under my care on the 24th of January, 1849, for an affection of the urethra. His bowels were habitually costive while resident in London. He was directed to take, in the first instance, compound powder of jalap; but this failing to operate, the oil of anda was administered instead. After swallowing for three consecutive nights thirty drops as a dose, he obtained a daily evacuation, and needed no further assistance in the way of purgatives.

L. C., aged forty-six years, a female of spare habit of body, subject to piles and to habitual constipation, so that she had rarely a motion within every four days, and while in that condition suffered from severe pain darting from the hip down the leg, procured relief by taking ten drops of the oil at bedtime.

A. M., aged twenty-nine years, admitted under my care for mammary abscess. Her bowels were always confined, so that she seldom had any passage except at an interval of eight days. Had taken full doses of castor oil alternated with compound rhubarb pill, and also a combination of Epsom salts and cream of tartar, without any result. On the 12th of February, 1849, twenty drops of the oil of anda were prescribed to be taken every night. On the 14th it is reported that "the doses taken on the 12th and 13th operated seven or eight times each day, without griping, and she felt generally better since. The bowels of an infant she was suckling were likewise freely moved, and the stools were green." She was then directed to take fifteen drops, which served to ensure adequate alvine discharge.

It may be observed, that the average dose of oil of anda administered was twenty drops, and to secure its entrance into the stomach it was swallowed on sugar. It offered nothing unpleasant to the taste, produced none of that heat in the throat which croton oil creates, seldom occasioned nausea or griping; it rarely operated within a period of two hours, although in one or two instances I have known it act within half an hour after its ingestion.

Towards the maintenance of health it may be laid down as an essential condition, that the effete remains of food, and of the spent tissues and secretions present in the alimentary canal, should be evacuated at periodical intervals. Human fæces, of which these may be said to form the aggregate, exhibit all the signs of putrifying matter; they have a putrid smell, and animalcules of the infusoria class are developed in them. Hence it may be readily supposed that if the fæcal excrementitious matter, averaging five ounces daily, be allowed to accumulate and remain for an undue length of time in the body, it must become a source of noisomeness and disease. It is, indeed, well known that some persons who have passed several days without being thus relieved exhale a stercoraceous odour. One of the worst forms of putrid fever I ever witnessed, and which eventually proved fatal, distinctly emanated from this cause. Everybody is familiar with the nuisance created by cesspools, when vent is not given to their fetid contents; and does it not seem strange that individuals of moderate intelligence should, from want of a little attention, actually carry for days within them a nucleus of pollution, a cesspool in miniature? It is to inhabitants of populous towns, who lead a sedentary life and are much confined within doors, that the above remarks especially apply; and without

more than strenuously urging here the paramount importance of air, exercise, and diet in obviating costiveness, I have briefly directed the notice of the society to a medicinal agent not heretofore employed in this country, and which may be found serviceable in promoting the above purpose.

"On the Colouring Matters of Dutch or Cake Litmus," by Jonathan Pereira, M.D., F.R.S.—The object of the present notice is to draw attention to the colouring matters employed by the Dutch to colour cake litmus, which, as is well known, is wholly imported from Holland.

The essential colouring matter of this pigment is obtained from lichens. In England two dyes or pigments only, both of a purple colour, are procured from these plants: they are orchil and cudbear; the former a liquid or pulp, the latter a powder. The substances which are essential to their production are certain lichens, water, ammonia, and oxygen (of the air). By the united agency of the three latter substances on certain colorific principles contained in the lichens, one or more coloured products are obtained, which, though probably not identical, pass under the general name of orceine.

In order to obtain the well-known blue colour, which is essential to the production of cake litmus, it is necessary to use, in addition to the ingredients above mentioned, a fixed alkali, namely, either potash or soda. Without this the product would be purple; in other words, it would be orchil or cudbear. The Dutch manufacturers use, I suspect, potash; for, if a cake of litmus be ignited in the outer cone of the flame of a candle, the flame acquires a whitish violet tint, indicative of the presence of this alkali. This suspicion is confirmed by the statement of Ferber,* who saw litmus in process of manufacture at Amsterdam, and who tells us that, besides the lichen, there were employed urine, lime-water, slacked lime, and potashes. The urine was used to yield, by decomposition, carbonate of ammonia, and the lime, of course, rendered caustic both the carbonate of ammonia and the carbonate of potash, and probably was otherwise useful in the process.

In order to give body to the blue colouring matter thus produced, and which I shall provisionally call lichen-blue, the Dutch employ some one or more earthy substances, to enable them to form the litmus into cakes. Ferber does not appear to have been aware of this; for he says that when the lichen has been sufficiently macerated, and the blue colour developed, the mixture is ground in a mill, which, he adds, he was not allowed to inspect. I presume that the Dutch manufacturer used something, in this part of the process, which he was anxious to keep secret.

The presence of the mineral or earthy constituent of litmus is readily shown by exposing some cakes of litmus, in a platinum or glass capsule, to the heat of a spirit-lamp. The colouring matter is volatilized and destroyed, leaving the fixed constituents, presenting the volume and shape of the original cakes. Into the composition of the ashes of litmus it is not the object of this paper to enter.

In order to give these cakes a strong blue colour, the Dutch manufacturer introduces into the paste another blue colouring matter, namely, indigo. Hitherto no one has alluded to the presence of indigo in cake litmus; yet the facts I am about to lay before the society leave no doubt, in my mind, of its existence in all the specimens of Dutch litmus which I have hitherto examined. Ferber, of course, makes no mention of it; and I have no doubt that one reason why he was not permitted to inspect the mill was that he might not discover the fact of the introduction, not merely of the earthy matter to give body to the cake, but also of indigo to give colour.

* *Neue Beiträge zur Mineralgeschichte verschiedener Länder*, Bd. i., S. 378, Mietau, 1778.

The existence of indigo in cake litmus is proved by the following facts:—

1st. The colour of the cakes is indigo-blue.

2dly. Their odour when fresh is essentially that of indigo. There is also a slight violet smell, which is developed by the lichens when undergoing fermentation, and which has led some writers into the error of supposing that Florentine orris is used in the manufacture of litmus.

3dly. If the cakes be rubbed with the nail they assume the well-known coppery lustre which characterizes indigo; but which, of course, is much less intense in the litmus cake than in a mass of pure indigo.

4thly. If the cakes be heated by a spirit-lamp, in a platina capsule or watch-glass, a vapour is evolved, which is known to be that of indigo by the following characters:—

α. Its peculiar and very characteristic colour.

β. Its reddish-violet colour.

λ. Its condensation in the form of beautiful coppery-purple crystals, which, when rubbed with oil of vitriol, form the blue liquid known as sulphate of indigo, and which is decolorized by hypochlorite of lime. The crystals, when examined by the microscope, present, when viewed as opaque objects, a beautiful coppery brilliancy; and, when viewed as transparent objects, by transmitted light, some of them are of a deep blue colour.

5thly. Litmus cakes, when deprived of their lichen-blue by digestion in distilled water or spirit, still retain a blue colour, showing that they contain a blue colouring matter insoluble both in water and spirit.

If these facts are considered sufficient to establish the existence of indigo in litmus cakes, it follows that the analyses of litmus hitherto published cannot be relied on, and, in fact, are of little value, since none of them make any mention of indigo as a constituent of litmus.

My examination of litmus cakes leads me to infer that they consist essentially of five parts:—

1. Lichen-blue.
2. Indigo-blue.
3. Organic remains (portions of the lichenous tissues).
5. An ammoniacal salt, separable from the cakes, by sublimation, in the form of carbonate of ammonia.
5. Mineral or earthy matter (chalk, &c.).

The lichen-blue is the peculiar colouring matter which renders litmus valuable as a test. It is soluble in water and in spirit, is reddened by acids, but does not become green by the addition of alkalis.

"On the Production of Plumose Alum at the Hurlet Mine, near Paisley," by Robert Christison, M.D., F.R.S.E.—Having had an opportunity not long ago of visiting the celebrated alum works and mine at Hurlet, near Paisley, I was fortunate enough to obtain a series of interesting specimens, illustrating the progressive spontaneous change of alum-slate into crystalline plumose alum. As so perfect a series is very seldom to be met with—indeed, almost by no one without a visit to the mine—I have thought that the Pharmaceutical Society may wish to possess a set, which I therefore send for their museum.

No. 1. Two specimens of alum-slate in the fresh unaltered condition. This slate constitutes the roof of an abandoned coal-mine, or coal-waste, of vast extent. It consists essentially of alumina, silica, bisulphuret of iron, and bituminous matter. The bisulphuret of iron in every stratum of this mine is remarkable for the facility with which it undergoes oxidation under exposure to the air. That property is exemplified by specimens 6 and 7. No. 7 is a specimen of pyrites, which is undergoing conversion into sulphate of protoxide of iron, being already covered on the surface, which was fresh in November last, with crystals of that salt. So great, indeed, is its tendency to oxidate, that, after it has formed a sufficient efflorescence of salt, it will be necessary to exclude it carefully from a free supply of air, otherwise in the course of time it will crumble to pieces, and all pass into the state of sulphate. It is worthy of notice that there seems no tendency to pass into the state of sulphate of the sesquioxide, or to form subsalts of that oxide. No. 6 consists of a few fragments of native copperas or sulphate of iron, the result of this process of oxygenation.

The bisulphuret of iron in the alum-slate possesses the same property. In the course of its oxygenation, one of its equivalents of sulphur, in passing to the state of sulphuric acid, combines with alumina; and the sulphate of alumina and sulphate of iron protoxide uniting together form, with a large quantity of combined water, the beautiful white silky crystals of plumose alum, which are seen at successive stages of development in the specimens 2, 3, and 4, and carefully detached in the pure state in the specimen 5.

The process of oxygenation is singularly favoured in the alum mine of Hurlet by a rare concurrence of circumstances. The alum-slate constitutes the roof of the coal-waste; so that when a thin layer scales off and falls to the ground it has time to split up and become porous, and consequently open to the entrance of air, before another layer falls over it. Then the roof of the mine is very dry, and the floor well drained, so that the plumose alum is not carried away as it forms, but remains to assist in splitting up the slate. Farther, the mine is always at a temperature of 60° to 63°, and its air damp. And, lastly, an unusual number of old pits have been left open, so as to secure a thorough supply of fresh air. This is an important condition; for it appears by calculation that about 600 times as much atmospheric air as is contained in the coal-waste is required to oxygenate the whole 20-inch bed of alum-slate. Nevertheless, the process of conversion into plumose alum is a slow one, so that in five years the specimen No. 4 consists of about equal weights of plumose alum and unaltered slate. I say unaltered, because I have found it to contain alumina, silica, and bituminous matter in abundance, and exactly the same proportion of bisulphuret of iron as the fresh alum-slate from the roof at the same part of the mine.

In some parts of the mine the plumose alum lies in such quantity on the floor that the feet sink through it; and, when the mine was first taken on lease by the late Mr. Charles Macintosh, the decomposed slate in some places filled up the entire five-feet space between the roof and floor.

For about twenty-five years after Mr. Macintosh commenced his operations in 1799, alum was made from the decomposed slate by a very simple process, which I have not seen noticed in any account of the alum-works at Hurlet, or anywhere else. The lixiviated slate yielded a solution of the two sulphates, from which sulphate of iron was first crystallized for sale; and the concentrated mother liquor was then used for making alum by adding to it a salt of potash.

But the increasing demand for alum, and the rapid reduction of the plumose alum in the mine, eventually rendered it necessary to have recourse to the process of calcination which had been followed for two or three centuries at other works; and since then oxygenation of the slate is accomplished partly by spontaneous efflorescence for two years, and partly by subsequent calcination, according to the method described in the recent English edition of Knapp's "Chemistry," as followed at Campsie Alum Works, which belong to the same manufacturers as those of Hurlet.

In describing my specimens I have been insensibly led into more details than I had contemplated, but possibly they may interest the society in connection with the specimens.

Edinburgh, April 16, 1849.

Mr. Scanlan observed that he had had some experience in the manufacture of alum at Whitby, in Yorkshire, and it was there found that the alum-slate did not undergo oxidation until it had been calcined. In this respect, therefore, it

differed from the slate found at the Hurlet mine. He believed also that the Hurlet slate was more productive than that at Whitby. At the latter place only one ton of alum was produced from sixty tons of the slate.

"On the Purification of Gum Arabic," by H. Picciotto, Esq.—It is known that gum arabic, of whatever quality, or from whatever country imported, contains, besides the pure mucilaginous substance called by some chemists "arabine," and which in all the different varieties is essentially the same, also more or less of all the following impurities, viz., ligneous and other insoluble fibre, sand, and other earthy substances and colouring matter; moreover, some varieties of gum arabic contain also a portion of that species called "bassorine," which is insoluble in cold or hot water. These impurities necessarily interfere more or less with the good results expected in the various uses of gum arabic, and the dark-coloured sorts are totally unfit for many uses. The object of the invention to be noticed in this paper is to separate all those extraneous matters from the gum, and, by thus decolorizing and purifying it, render it finer, more useful, and better available for both pharmaceutical and manufacturing purposes. This object is effected by the following process, which, after a long series of experiments and researches, conducted during the period of four years, I have found to be the best on all accounts.

Having prepared a strong and purified solution of sulphurous acid gas, I introduce into it some gum, in the proportion of one of the latter to about six or eight of the former; the mixture is kept protected from the contact of the air, and, when the gum is dissolved, it is found that all or most of the colouring matter has combined with the acid, and the other impurities have precipitated. Heat is now applied to the vessel, and the warm liquid is run off into a large receiver containing a quantity of carbonate of baryta in excess. Immediately a combination takes place, forming a perfectly insoluble sulphite of baryta, to which the colouring matter remains united, carbonic acid gas is evolved, and the liquid remains nearly colourless. Then it is filtered through some very close filters, such as would not allow the passage of any particle of solid matter, and thereby a pure, limpid, and tasteless solution of gum is obtained. Sometimes the whole of the colouring matter has not been removed, and a repetition of the process is necessary to obtain a perfect whiteness. The purified filtered solution is then concentrated by evaporation at a moderate temperature, and reduced to any required degree of density, or to complete dryness. I have constantly found that none of the physical and chemical properties of the gum thus operated upon are in any way affected.

There is also another method of separating the acid from the gum in solution, equally effective, but a small portion of colouring matter remains in the gum; it is by boiling the mixture in vacuum at a temperature under 120° Fahr. The gas which is volatilized may be absorbed by charcoal placed in the receiver, or may be conducted through a pump into another receiver containing water. The solution of gum, when the process is finished, remains free from acid, if during the whole operation it has been well protected from contact with the atmospheric air.

The process described may be varied in its details, but the principles remain essentially the same; and the gum obtained, after filtration, is not found to contain the slightest particle of any of the ingredients used, and is undoubtedly purer and whiter than the finest sample of the picked white Turkey gum.

Now, I may be allowed to add a few remarks, considering the matter in a commercial point of view. At present the white gum arabic is a scanty product of nature: we are dependent for its supply upon the one country (viz., Egypt), which alone produces the article; frequently French or Austrian merchants established at Alexandria make a monopoly of it, and whatever portion is imported into this country must pass through their hands. Hence its price is high, and its uses are rather restricted. Were the supply more abundant, and the cost price somewhat more moderate, the consumption would increase enormously, for there are several trades in which white gum arabic would be used very largely, and with great advantage to the articles produced, instead of various substitutes now in use, all of which are wanting either in the brilliancy of the gum, or in some other of its useful properties. Of this I have the direct testimony of manufacturers, especially in the silk trade. The employment of the purified gum will assuredly improve the products of several British manufactures of considerable importance. In other respects also the general introduction of this article will be beneficial to English commerce. It will render us independent of the monopoly carried on by foreign merchants in Egypt; and it will give an increased value and importance to the produce of British possessions and colonies, such as East India, Australia, Cape of Good Hope, &c., by rendering the sorts of gum arabic imported from those countries available for purposes to which they could never hitherto be applied.

"An Account of the Pitch Lake of Trinidad," by Mr. Darling.—The pitch lake at Point de Brea, Trinidad, is a mass of bitumen, called a "lake" from its resemblance to a sheet of water, of which it forcibly reminds you, although, from the blackness of its surface, it has a very sombre appearance. It is about two miles in circumference, and lies in a direct line about half a mile from the sea, and at an elevation of 138 feet above low-water mark; it is approached by a road formed chiefly of pitch, which for the greater part is very wavy and uneven; its length is about three quarters of a mile. On the lake there are several small patches of vegetation, having much the appearance of islands; they seem to have been formed by the collection of a small portion of vegetable mould, to which some seeds have been conveyed, and it has at last increased till sufficient to afford support to several well-grown trees, of which many of the clumps can boast.

About half the lake is skirted by "high woods," as the original growth is called; the remainder is bounded by "brush," or a lower description of wood, which is a second growth, and a tall reed, called the "wild cane," or "white roseau," which at this time of the year (October) is very pretty, from being surmounted by its "arrow," or flower, which resembles a feather at the top of a slender rod of fifteen or twenty feet high. Amongst the wood and brush grow some very beautiful palm-trees, of which the most remarkable is called the "pitch lake palm," from its being almost confined to this part of the island; but I believe the correct name is the "moriché," or "tallipot palm." The stately palmise and the graceful palmetto, as well as the locorite palms, also abound.

The surface of the lake is closely intersected by V-shaped cracks or fissures, formed by the waves of pitch not meeting for some distance below the level of the surface: some of these are five or six feet deep in the centre; they vary from three to fifteen feet in width, and in some places form themselves into little ponds, and are always full of water. It is singular that the water in these gullies is at all times perfectly fresh and sweet, and of good quality, and that they are constantly quite full, even in the dry season, when there may not have been a shower for two months. This is probably to be accounted for by the heat of the sun acting on the surface of the pitch, and closing it to the edge of the water as the quantity of the latter lessens. In the water is a good deal of moss, and small fish are to be found in all the pools.

The depth of this body of bitumen has never been ascertained, but I am inclined to think that it is considerable, as in all the neighbourhood of La Brea it constitutes the lowest stratum, and in some places forms a bank in the sea at the depth of a fathom and more, although the land in the vicinity does not indicate the presence of bitumen.

On the surface of the lake are several craters or sources from which the pitch exudes very sluggishly. Some of these are very trifling indeed, not throwing out a stream (the motion of which is hardly perceptible) of more than three inches in diameter, and some much less; but about the centre of the lake the principal crater is generally to be found, for it changes its place. The flow from it is considerable, though, like the others, very slow; for about ten feet around it the pitch has something the appearance of boiling lead, and is so soft that it cannot be walked upon: this softness seems to prevail to a great depth, as the longest rod we could procure was easily pushed to its full length into it. This crater is not much elevated. In this, or a similar one, an ox belonging to one of the neighbouring estates was caught by attempting to cross it; he gradually sank, and at length disappeared, in spite of all the attempts which were made to extricate him.

This soft semi-fluid state is that in which the bitumen is found when it is called petroleum; being at first nearly liquid, but it acquires solidity by exposure to the air, and the evaporation of the naphtha, and it then takes the name of asphaltum. Its colour is black, with a shade of brown; it varies in hardness according to the length of time it has been exposed; is generally found slightly impregnated with earth; and it contains in some instances pieces of wood in different states of carbonization. Its analysis by Dr. Gould, of this island, gave—

Oil of tar	34 parts
Charcoal	35 "
Hydrogen, gas, and oxide of iron	31 "
	100

It is very heavy, and has lately been made use of for fuel for steam-engines, the boiling of sugar, distilling, &c., with tolerable success; and as it differs little from Newcastle coal, except in wanting twenty-eight per cent. of charcoal, it is not unlikely that, by the addition of some wood, it may be found sufficiently good to supersede the use of coal in this island.

The petroleum is found in small springs in various parts of the island; it is also found in combination with sand or stone, and in this state forms the asphaltic rock. About twenty parts of this bitumen combined with eighty parts of pulverized stone, formed into a mass by heat sufficient to expel the naphtha, is the asphaltic cement at present so much spoken of. Lime and sand also serve to harden it.

Two bituminous substances, besides those already described, are found in the neighbourhood of La Brea: one is like a very pure specimen of asphaltum, but comes very near what mineralogists describe as jet. It is found in rather kidney-shaped masses; breaks easily with a very bright surface, like sealing-wax; is solid, very black, and when heated will take an impression like sealing-wax; it is lighter than the pitch of the lake. The other is bituminous wood, which in its shape resembles the branches of trees a little flattened: it is of a dark brown colour, shows the grain of the wood, and burns with a bituminous smell, and by the application of heat emits gas.

HEALTH OF LONDON DURING THE PAST WEEK.

[From the Report of the Registrar-General.]

The 1,217 deaths registered in the week exhibit an excess of 254 above the weekly average of the quarter, which ends on June the 30th; but this unusual result is due only in part to an increased rate of mortality. The registration of a considerable portion of those deaths on which inquests were held, though they occurred at an earlier period, is not completed till the end of the quarter; a fact by which is explained the accumulation of deaths observed in the present

return, from fractures, hanging, drowning, poison, burns, and some vaguely described as "natural," or "from the visitation of God." The number now returned by coroners, as caused by violence is upwards of 80, though the weekly average is only 29; those enumerated as "sudden deaths" are 46, though the average does not exceed 11; an excess, for the same reason, is found under "apoplexy," the cases returned being 42, while the average is 24. But the mortality from diseases of a tubercular nature, and from those of the organs of circulation, differs little from the average; that from diseases of the respiratory organs falls considerably under it. In the zymotic or epidemic class the increase is remarkable; here, the deaths which in the two previous weeks were respectively 251, 277, were last week 349, whilst the average is 198. The fatal causes in this group which attract notice are hooping-cough, from which there were 53 deaths (the average being 36); diarrhœa, from which there were 30, whilst the average is 12; and cholera, from which 124 deaths are enumerated. The recent progress of this disease is shown by the weekly returns; for in four previous weeks the fatal cases were respectively, 9, 22, 42, and 49. Last week it was fatal to 76 males and 48 females, of whom only 5 were under 5 years of age; 21 between that age and 15 years; 88 at 15 and under 60; and 10 at 60 and upwards. Few deaths from it occurred in the north districts. Mr. Western, the registrar of St. James's, Clerkenwell, reports that a man died from "fever" after an illness of 6 days. He had lain on the floor of a miserable hovel 6 feet square, and within a few feet of nuisance which accumulated and overflowed in the court. Two cases are ascribed to intemperance, two to privation, and a young man of 18 years died in Pancras of "phthisis," while left in a destitute condition by his father, who had deserted him. A woman died in the City-road sub-district at the advanced age of 100 years.

The mean height of the barometer during the week was 29.870 in. The mean temperature of the week was rather higher than the average of seven years, though under it during the last three days. It was about 5° higher than the average on Tuesday and Wednesday; and on the former day the highest in the shade was 75°6; in the sun 100°7. The mean temperature of the week was 60°2.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Frank Clarke Hills, of Deptford, in the county of Kent, manufacturing chemist, for improvements in treating certain salts and gases, or vapours. Patent dated October 19th, 1848. Enrolled April 18th, 1849.

The first part of this invention has reference to the treatment of coal-gas, whereby it is rendered of greater illuminating power, and by which also a greater amount of gas is obtained from a given quantity of coal. According to one method given the patentee deprives the thick coal-tar—produced in the ordinary manufacture of gas—of its naphtha; the tar, while hot, is mixed with a quantity of breeze or ordinary gas coke, in such proportion that it will become hard when cold. In distilling gas from this substance it may either be mixed with coals before introducing it into the retorts, or it may be distilled separately; but preference is given to the mixing it with coals. By this mode of treatment the gas is much improved in illuminating power, and a greater amount of gas is obtained from a given quantity of coal, besides converting the breeze into coke, which latter is much more valuable than breeze. Instead of mixing the tar deprived of its naphtha with breeze, coals may be used to solidify it, as described. By another method given the tar previously deprived of its naphtha is to be run into retorts kept at a red heat, preferring them to be set on their ends, and partially filled with coke or some similar substance, to present a heated surface; the tar coming in contact with the coke is converted into gas, which should be drawn off from the bottom of the retort. The supply of the tar should be continued till the retort is about two thirds filled, when the coke must be removed. For this purpose the patentee prefers using what are termed reciprocating retorts, in which the gas from one retort is introduced to another. The vapour of naphtha, obtained by the distillation of tar, may either be passed through a refrigerator and condensed into naphtha, or may be converted into gas by passing it into retorts kept at a red heat, and which contain coke, bricks, or other substances suitable to obtain a great amount of surface; by this means an increased illuminating power is imparted to gas. The illuminating power of gas obtained by the distillation of tar, pitch, or other rich hydrocarbons, will be improved by combining with it the gases obtained by the distillation of wood in the production of pyroligneous acid. The patentee claims under this head of his invention:—

First. The mixing pitch or coal-tar deprived of its naphtha with breeze, coke, or small coal, to be used in conjunction with ordinary coal in the manufacture of gas.

Secondly. The running thick tar or pitch into retorts kept at a red heat, and which are in part filled with coke or other similar substances, in order to present a heated surface.

Thirdly. Passing the vapours of naphtha obtained by the distillation of tar through red-hot retorts containing coke or other substances, so as to form a highly-illuminating gas; and

Fourthly. The mixing the various gases from wood (obtained in the production of pyroligneous acid) with gas obtained from hydrocarbons or from coals.

The second part of the invention relates to a method of distilling the volatile solution of ammonia for the purpose of producing ammonia of a more highly concentrated character; and also to the concentration of saline solutions; and also to that of sulphuric acid. For this purpose the patentee employs a circular tower about ten diameters in height; this is to be furnished with gratings, placed from three to four feet apart throughout the whole height; the spaces between them being filled with coke, pieces of earthenware, or other substances of a nature to form a greatly-divided medium for percolation. The volatile solution to be distilled, whether pure or combined with other matters, is to be introduced at the top of the tower, and allowed to percolate through the coke, &c., while, at the same time, a jet of steam or heated air is introduced at the bottom, which, in its ascent, meets the ammonia distributed over a great amount of surface, by which means the more volatile parts of the ammonia become vaporized, and are carried off by the steam, which is finally collected at the top and conveyed to a refrigerator and condensed, while the waste liquor escapes at the bottom of the tower. As an auxiliary to this apparatus, another tower is placed at the top of that already described; this the patentee calls a "concentrator;" it is filled with similar materials as the lower tower, and furnished with a coil pipe, through which the solution of ammonia is made to pass when introduced to the lower tower; the vapours arising from this partially vaporize the ammonia in the pipe, while, at the same time, the more aqueous parts of the vapours are condensed before passing off to the condenser.

The concentration of non-volatile saline solutions is effected by the patentee at moderate heats, by employing a similar tower to that already described, and in which the saline solution is introduced at the top, and allowed to percolate through the medium placed therein, which (in this case), as well as the gratings and other appurtenances, should be non-combustible. A current of air, or of the gaseous products of combustion, is allowed to ascend the tower, being drawn off from the top by draught or otherwise; this current comes in contact with the saline solution, from which it absorbs the aqueous particles, the liquid being delivered in a concentrated form at the bottom of the tower. In driving off the aqueous vapours of sulphuric acid for the purpose of concentration a process similar to the one just now described is followed, but in this case the media contained in the tower, for the creation of an extended surface, should consist of pebbles, or similar substances on which the acid will not take any effect. The tower should also be lined with earthenware, for a similar reason, and also the gratings—which, however, in this, as in the other cases, may be omitted if considered desirable.

The patentee claims under the second head:—

First. Distilling the volatile solution of ammonia, whether pure or mixed with other matters, by running the solution through the divided medium in any convenient chamber or still, and admitting heated air or steam in an opposite direction to the same, or so as to come in direct contact with the solution, and thereby vaporize and carry off the more volatile portion, as described.

Secondly. The concentrating of the saline solutions, by causing them to percolate through a medium contained in a tower, whilst a current of heated air, or of the gaseous products of combustion, is caused to pass through or over the same medium.

Thirdly. The driving off the more aqueous vapours of sulphuric acid by passing heated air, or the gaseous products of combustion, through a tower containing a suitable medium, through which medium the sulphuric acid percolates, as described.

The third part of the invention consists of a method of impregnating liquids with gases or vapours that are soluble therein.

The use of the tower is adopted when impregnating water, weak ammoniacal solutions, or weak acids, which are allowed to percolate, as before described; but in this case through a medium consisting of sawdust, tan, cocoa fibre, or other like substance; the gratings being such as to prevent the passage of the sawdust or other matters used. The vapour or gas with which the water, the ammoniacal solution, or the weak acid is to be impregnated is introduced at the bottom of the tower, and as it ascends comes in contact with the fluid; and, this being diffused through the medium, it presents a greatly extended surface to the action of the vapour, which consequently thoroughly impregnates it; the impregnated fluid is then delivered at the bottom, while any vaporous residue is carried off at the top. Fixed saline solutions intended to be impregnated are to be diluted with water; coke, breeze, or other similar materials are used as the percolation medium.

Instead of a tower, the patentee sometimes employs a horizontal cylinder, in which a shaft revolves, having matting or some other fibrous substance attached to it, of a sufficient length to touch the interior of the cylinder as the shaft revolves, the matting being thrown out by the centrifugal force. This cylinder is partly filled with the solution to be impregnated, the space above being occupied by the vapour, in which the solution becomes dispersed by the rotating shaft, thus exposing it in such manner that the vapour readily combines with the solution.

The patentee claims under this head:—The effecting the absorption of vapour by liquids, for which they have an affinity, by the methods before described.

The fourth part of the specification has reference to the removal of noxious vapours or gases injurious to health from vessels having contained matters likely to generate such gases or vapours. The patentee proposes to effect the removal of the noxious vapours from absorbing vessels, gas purifiers, and ammonia saturators, by simply passing a current of air or steam through the purifier, &c., and thence conveying it into a chimney, by which the noxious vapours will be carried off. If a current of air be employed, this may either be heated or used at the ordinary temperature. The currents should be introduced at the upper part of the chamber, and allowed to pass off near the bottom; they

should be produced either by draught or by mechanical means. In drawing off the vapours explosive compounds are liable to be formed. This tendency may be counteracted by mixing with the vapours air, steam, carbonic acid, or some other suitable gas, in sufficient quantity for the purpose.

The claims under this head are :—

First. The removal of noxious vapours from ammonia saturators, gas purifiers, or absorbing vessels, by causing a stream of air, steam, or any other suitable gas or vapour (either heated at or above the natural temperature) to pass through them, either by draught or by mechanical means, and conveying the current to a chimney or shaft, by which the noxious vapours are carried off.

Secondly. Preventing the formation of explosive compounds in the gases drawn from the vessels or materials referred to by the admixture of air, steam, or carbonic acid, or other suitable gases, in sufficient proportion to render the whole of a non-explosive character.

The fifth part relates to a new arrangement for the distribution of the liquids used in stills, by which arrangement the liquids are distributed equally over the area of the still. The apparatus employed consists of a series of tubes, which are placed at equal distances of about eighteen inches over the upper part of the still, in an horizontal position. These tubes have a series of small holes, bored in opposite sides, at regular distances apart, through which the liquids issue. These horizontal tubes are connected with a main tube, leading to a small supply cistern, in which the liquid is delivered intermittently. By this arrangement the tubes are flushed at regular intervals, rendering the supply equal over the whole surface of the still. This intermittent supply is regulated by a tumbling-box, into which the liquid is supplied by a stopcock at any required velocity. The tumbling-box is divided into two compartments, which as they become filled preponderate alternately, and empty their contents into the basin below; this at the same time brings the other compartment under the cock, which is filled and emptied in turn.

Another means of distributing liquids is given, in which a vertical tube is placed in the centre, having radial perforated arms, through which the liquid is distributed, the vertical tube being caused to rotate on its arms during such distribution.

For this part the claim is:—The distributing liquids equally in a still, or in an absorbing vessel, by means of a tumbling-box, or revolving perforated arms, as described.

The last part of the invention refers to a method of depriving coal-gas of its naphthaline. This is effected after the gas has been subjected to the process of purifying, but before its admission to the gasometer, by passing it through a vessel similar to a wet lime purifier, and in which a solution of caustic potass (or soda) and lime is placed. The transmission of the gas through this vessel will free it from a considerable portion of its naphthaline, the latter being retained by the alkalis.

Under this last head the patentee claims the freeing coal-gas from its naphthaline, by causing it to pass through a solution of caustic potass and lime, or caustic soda and lime, as explained.

Soren Hjorth, of Jewry-street, Aldgate, for certain improvements in the use of electro-magnetism and its application to motive power; and also other improvements in its application generally to engines, ships, and railway locomotives. Patent dated October 26th, 1848. Enrolled April 26th, 1849.

The patentee proposes to effect the practical application of electro-magnetism to the purposes of motive power, to the same ends and in a somewhat similar manner to that for which that universal power, steam, is now applied. The ordinary parts of the apparatus, shown and described in the specification, are similar to those usually adopted in an ordinary steam-engine; such parts, for instance, as the main-shaft, flywheel, cranks, bearings, and framings; but the cylinder of the steam-engine is replaced by a peculiar arrangement of stationary and moveable magnets, through which the currents of electricity pass; and the attractive or the repulsive action of the poles of the magnets communicate their power through a connecting rod to the crank upon the main-shaft, in the same manner as in the steam-engine.

The stationary engine employed, and which constitutes part of the motive-power apparatus, is of the horseshoe form, and around it the necessary coils of wire are wound. The magnet is provided near its lowest part with journals or trunnions, which move in bearings secured to the base of the framing; this allows a vibratory or oscillatory movement of the magnet. The interior of the magnet is formed of a conical or taper shape, being somewhat larger at the upper than at the lower part. To the bottom of the interior are fixed a number of taper or conical rods or projections of different lengths. These project upward inside the magnet. There are also two guide rods, secured by nuts to the lower part of the stationary magnet. These likewise project upwards towards the crank-shaft, which is situated above in a horizontal position. The tops of these guide rods are firmly secured by nuts to a cross-head and through a hole, in a central boss of which passes a connecting rod, the upper end of which is attached to a pin upon the crank, in the usual manner of such apparatus; and to the lower end of the connecting rod, below the cross-head and between the guide rods, attached to the lower and stationary magnet, is attached the upper or moveable magnet, which is likewise coiled with wire, as usual. The exterior form of this magnet coincides with the interior form of the lower or stationary magnet; and there are likewise conical recesses, corresponding in number and form to the conical projecting rods upon the lower magnet; and, when the upper or moveable magnet descends, it passes into the lower or stationary magnet, and the projecting rods into the recesses; but the surfaces do not actually come into contact. Thus, upon the passing of the current of electricity through the magnets the attraction or repulsion is induced, and the moveable magnet is put in motion; and by means of the connecting rod and crank a rotary motion is given to the crank-shaft. In consequence of the conical forms of the magnets and their surfaces, the power exerted is maintained throughout the stroke by passing the poles of the moveable magnets past those of the stationary ones, and thus exerting a continual series of attractive and repulsive efforts. The magnets and apparatus before described are joined by the connecting rod to the crank upon one end of the horizontal shaft; and to the other end of the shaft an apparatus exactly similar is annexed, their respective cranks being opposite to each other, so that the action of the magnets is alternate, the one being ascending while the other is descending, and so on, ensuring thus a constant impulsive power to the main-shaft. For the purpose of changing the current of electricity from one of the combinations of the magnets to the other, and back again, the inventor employs an apparatus which he calls a commutator, the action of which is nearly identical with that of the ordinary slide valve of the steam-engine. This apparatus is constituted of a face or surface of some non-conducting substance, and into this are inserted three pieces of metal, or other material, having a conducting property; these pieces are placed a short distance apart from each other; the middle piece communicates with the battery, and the other two respectively with the two systems of magnets before spoken of. Upon the surface thus prepared a metal plate is placed, the length of which just exceeds the distance between the two extreme pieces; this plate when moved comes in contact with the one at the moment before it entirely leaves off contact with the other; thus the current of electricity is never broken, though it is made to alternate between the two systems of magnets. The plate is worked by an eccentric upon the crank-shaft, precisely in the same manner as the valve of a steam-engine. The patentee employs a governor in connection with the current of electricity, for the purpose of regulating the force of the current of electricity passing to the magnets, according to circumstances. A pair of governor balls of the construction usually employed in steam-engines is driven from the crank-shaft of the machinery, and any variation in the velocity thereof acts upon the balls in the usual manner; these balls act upon the apparatus for regulating the intensity of the current, and which apparatus consists of a fork-like piece of metal, the prongs of which are flat, and of a taper shape, the flat parts moving or sliding against two flat surfaces, one of which is connected with the battery, and the other with the magnets. The action of the governor balls moves the taper surfaces of the prongs further off or on these surfaces, and thereby decreases or increases the intensity of the electric current passing through them, according to the power required.

The drawings accompanying the specification show the adaptation of the patentee's invention to the purposes of a stationary motive engine; but he states that it is equally applicable to other purposes, and in other forms, where motive power is required, by the arranging and constructing the apparatus accordingly; thus, for example, it is applicable to the raising of heavy weights, to the working the ram of a pile engine, or the working of a heavy hammer. In these modes of application tappets are employed to break the circuit of electricity at the requisite times.

The patentee also employs magnetic electricity for the purpose of increasing the adhesion of the wheels of railway engines and carriages upon the rails. Permanent magnets, of a horseshoe form, are so placed over or around the wheels that the inside parts of their poles shall coincide with a number of pieces of soft iron, or electro-magnets, fixed between the spokes of the wheels; and between the wheels and around the axle is placed a cylinder of sheet iron, upon which wire is coiled. When the wheels are in motion upon the rails electricity is induced in the coils around the sheet iron cylinder, and the magnetic power increasing as the speed of the carriage increases will increase the adhesion of the wheels upon the rails, and the electricity thus induced may be made available for the purpose of propelling the carriage forward by means of the electro-magnetic engine before described. Similar arrangements may be applied to fly-wheels of stationary engines, paddle-wheels of marine engines, &c. &c., and the electricity induced employed as an auxiliary power.

The patentee describes another form of commutator or current changer, by which the ends of two vibratory arms attached to the journal or axis of the stationary magnet come in contact alternately with springs, by which the current is changed and passed through the springs to the magnets alternately, care being taken so to adjust the springs that one arm shall come into contact with one of the springs before the other arm has left the other spring. By this means the current is never broken.

The patentee likewise describes a mode of applying his invention to the construction of a rotary engine, by which a constant and direct pull, and a continuation of the polarities, are obtained. A number of stationary magnets are placed around a centre, which may be of rods of different lengths, and so arranged as to form a case, with slits towards the centre for the arms of the moveable magnets, which are fixed to a shaft at the centre. The ends and surfaces of the rods or the stationary magnets form angles with the direction of the movement of the moveable magnets, so that one set of them commences to exert their influence before the others terminate theirs. Thus a constant circuit of electricity is maintained, and the resulting power continuous.

He also describes a mode of obtaining a semi-circular or reciprocal rotary motion, which is after converted into a rotary one. This apparatus is but a modification of the foregoing, the current of electricity being broken.

The patentee claims :—

First. The arranging, constructing, and combining magnets, so that they shall exert their attractive or repulsive force mutually, by a continuous and direct attractive or repulsive action upon points which present themselves successively during the whole stroke, for the production of motive power by means of electro-magnetism, as described.

Secondly. The regulating the current of the electric fluid by allowing it to pass through substances presenting different amounts of surfaces, and touching or rubbing each other, so that their areas in contact shall be increased or diminished by means of a governor, and thus allowing a greater or less amount of the electric fluid to pass, according to circumstances, for the production of motive power by means of electricity, as described.

Thirdly. The changing the direction of the current of electricity, by means of a commutator, in its use and application as a motive power, as described.

Fourthly. The use of electric magnets in combination with engines and carriages upon railways, for the purpose of increasing the adhesion of the wheels upon the rails, and also as an auxiliary power for engines on railways, or applied to stationary or marine engines, as described.

Fifthly. The arrangements described for producing a rotary movement, by a direct pull or thrust, and a continual succession of polarities, as described.

Sixthly. The arranging and combining magnets in such manner that a semicircular motion, or a reciprocal rotary motion of the moveable magnet, may be obtained, and the power transferred either to the work directly, or through the medium of cranks and connecting-rods, and other apparatus, to a revolving shaft, as described.

Seventhly. The combining the several arrangements described for the application of electro-magnetism as a motive power to engines, ships, and railway locomotives.

Thomas Drayton, of Regent-street, practical chemist, for improvements in the silvering of glass and other surfaces. Patent dated December 4th, 1848. Enrolled June 4th, 1849.

The patentee takes one ounce of ammonia, two ounces of nitrate of silver, three ounces of water, and three ounces of spirit of wine. He mixes these ingredients together, and lets the mixture stand at rest for three or four hours. He then filters it, and adds for every ounce of the filtrate a quarter of an ounce of sugar (grape sugar, if possible) dissolved in equal quantities of water and alcohol.

This preparation may be used for silvering glasses presenting either flat or hollow surfaces; the depositing of the silver may be effected either in a horizontal or vertical position, taking care to keep the fluid in contact with the entire surface; the glass during the process being maintained at a temperature of 160° Fahrenheit.

The patentee observes that his process is free from the unwholesome and disagreeable emanations which attend other processes of silvering; and that the coating is not affected by heat or damp, and accordingly adapted equally for any climate. When the silver has become thoroughly dry, it is to be coated over with mastic varnish, which serves as a protection from friction.

The preparation is equally well adapted for silvering the surface of metals.

The patentee desires it to be understood that he does not confine himself to the precise details given, so long as the peculiar character of his invention is retained, viz., to deposit silver on glass in such manner as to cause the metal to adhere to the glass, without any previous coating being required, and without the use of oils.

Francis Hastings Greenstreet, of Liverpool, engineer, for certain improvements in hydraulic engines. Patent dated December 2d, 1848. Enrolled June 2d, 1849.

This invention has reference to improvements in hydraulic engines used for obtaining motive power from a head of water, the water acting on a piston in a cylinder in a similar manner as in the ordinary steam-engine; the improvements lying in the arrangement or disposition of the valves for regulating the ingress and egress of the water to the working cylinder, and also in the manner of working the same. The engine is represented as consisting of two cylinders, a large and a small one, placed parallel to each other in a horizontal position, the larger being the working cylinder, and the smaller one containing the valves. These cylinders are furnished with communications at either end, which terminate in the valve cylinder between two valves, the one being the inlet and the other the outlet valve; the inlet valves opening from the central or middle portion of the cylinder, and the outlet valves opening to the ends, whence the spent water escapes to the atmosphere. The middle portion of the cylinder is connected with the column of water. The valves are constructed very similar to the ordinary circular dampers used in stoves, in which apertures are cut in a disc, so as to cover or uncover openings in the surface forming the valve face. These valves are the whole diameter of the small cylinder; and, as before mentioned, the inlet valves are placed close to the ports or passages in such manner that the pressure of the water takes effect on the back of the inlet valves, the outlet valves being similarly disposed, but beyond, or at the extremes of the ports or water passages to the cylinder. The whole of these valves are mounted on one central spindle, which has an oscillatory motion imparted to it; the valves being so fixed to it that the one inlet valve is gradually closing while the other opens in the same proportion. The position of the outlet valves is altered by the same partial rotation of the valve shaft, so as to close one waste, and open that to the full side of the cylinder. The outlet valve, which has just been closed, cuts off the passage of the water from the supply, and directs it into the cylinder. The water taking effect on the back part of the valve counteracts the pressure on the back of the closed inlet valve at the opposite end of the cylinder. A like effect being produced during both strokes of the engine, the pressure of the column of water on the valves is a matter of indifference, as no greater friction is produced on the faces at a great pressure than would result from a low pressure. With regard to the working of these valves, this is effected by a lever arm, supporting a weight, and placed in a vertical position on the end of the valve shaft; it is not fixed to this shaft, but merely oscillates on it as on a centre. The movement of the lever is transmitted to the shaft by a pin in the side of the lever, which takes into a notch in the circumference of a disc or plate keyed on the shaft, which admits of a limited movement of the lever before actuating the shaft. The weighted lever is alternately thrown from one side to the other of the vertical line, similar to the method generally adopted in changing the strap of a planing machine from one pulley to the other. The motion of the lever is imparted to it from a frame in the form of a parallelogram, with its sides so inclined to its direction of motion as to raise the weight to the vertical position, beyond which it falls, so as to complete the motion of the valves by its own gravity; the motion of the weight lever being further limited by a guard rail, or chase. The inclined frame is sustained in position by suitable guides, and worked by an arm from the piston-rod. By this arrangement the engine, although not fitted with any fly-wheel, completes its stroke, and reverses the position of the valves, so as to change the pressure side of the piston, while, by any other arrangement, the piston would—so soon as the pressure on its opposite sides was in equilibrium—cease to move.

The advantages of this arrangement are, that an equilibrium is maintained between the valves, thereby obviating the great friction that would result from a high fall of water, and also avoiding the concussion from the complete stoppage of the water, consequent on any other system of valves, at each stroke of the engine.

The patentee does not confine himself to the form of valves described, but he recommends that form as giving a large opening for a small amount of motion; and he claims the arranging and combining four distinct valves, connected by a spindle, or series of jointed rods (as the case may require), in such a manner that the pressure on the back of one valve shall counteract the pressure on the other; and also, that as the one valve, communicating with the head of water, shuts in the same proportion that the other valve opens, no stoppage or concussion shall ensue, but the course of the water be merely diverted, so as to exert its pressure alternately on opposite sides of the cylinder.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING JUNE 30TH, 1849.

Henry Bessemer, of Baxter-house, St. Pancras, in the county of Middlesex, engineer, for improvements in the methods, means, and machinery or apparatus employed for raising and forcing water and other fluids. Patent dated June 23d, 1849; six months.

Thomas Merchant, of Derby, civil engineer, and Robert Harland, of Derby, carriage-builder, for certain improvements in the construction of railway carriages. Patent dated June 25th, 1849; six months.

George Benjamin Thorneycroft, of Wolverhampton, iron-master, for improvements in manufacturing railway tyres, axles, and other iron articles, where great strength and durability are required. Patent dated June 26th, 1849; six months.

Thomas Wood Gray, of Limehouse, brass-founder, for improvements in water-closets, pumps, cocks, lubricators, and deck lights. Patent dated June 26th, 1849; six months.

James Nasmyth, of Patricroft, near Manchester, engineer, for certain improvements in the method of, and apparatus for, communicating and regulating the power for driving or working machines employed in manufacturing, dyeing, printing, and finishing textile fabrics. Patent dated June 26th, 1849; six months.

James Leadbetter, of Kirkby Lonsdale, Westmorland, brazier, for certain improvements in the method of raising water and other fluids; which improvements are also applicable to the propulsion of machinery, pumping of mines, and other similar purposes. Patent dated June 26th, 1849; six months.

Walter Neilson, of Hyde-park-street, Glasgow, engineer, for an improvement or improvements in the application of steam for raising, lowering, moving, or transporting heavy bodies. Patent dated June 26th, 1849; six months.

Christopher Nickels, of York-road, Lambeth, gentleman, for improvements in the manufacture of woollen and other fabrics. Patent dated June 26th, 1849; six months.

William Wilson, junior, of Campbellfield, Glasgow, Scotland, for improvements in cutting plastic tubes or tiles. Patent dated June 27th, 1849; six months.

John Thomas Forster, of Plymouth, a master in her Majesty's navy, for improvements in the building of ships, boats, and other vessels; also in the manufacture of boxes, packing-cases, roofs, and other structures requiring to be waterproof. Patent dated June 27th, 1849; six months.

Edward Woods, of Liverpool, in the county of Lancaster, civil engineer, for certain improvements in turntables. Patent dated June 28th, 1849; six months.

Thomas Beale Browne, of Hampen, in the county of Gloucester, gentleman, for certain improvements in looms, and in the manufacture of

woven and twisted fabrics. Patent dated June 29th, 1849; six months.

Bram Hertz, of Great Marlborough-street, in the county of Middlesex, gentleman, for improvements in, and an addition to, fountain pens. Patent dated June 30th, 1849; six months.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF SCOTLAND, FROM THE 22D DAY OF MAY TO THE 22D DAY OF JUNE, 1849, INCLUSIVE.

Moses Poole, London, Middlesex, gentleman, for improvements in apparatus for drawing fluids from the human or animal body. Sealed 23d May, 1849; six months.

William Newton, of London, Middlesex, civil engineer, for improvements in the jacquard machine. Sealed 28th May, 1849; six months.

Henry Vint, of St. Mary's Lodge, Colchester, in the county of Essex, gentleman, for improvements in propelling ships and other vessels. Sealed 29th May, 1849; six months.

Malcolm Macfarlane, of Thistle-street, in the city of Glasgow, North Britain, coppersmith, for certain improvements in machinery or apparatus for the dyeing and finishing of woven fabrics. Dated 29th May, 1849; six months.

Elijah Slack, of Orchard-street, in the burgh of Renfrew, North Britain, gum-manufacturer, for an improvement or improvements in the preparation of materials to be used in the manufacture of textile fabrics. Sealed 31st May, 1849; six months.

Edward Buchler, of the city of London, merchant, for improvements in the manufacture of boots and shoes; also applicable to other fabrics. Sealed 5th June, 1849; four months.

Jacques Hulot, of Rue St. Joseph, Paris, in the Republic of France, manufacturer of fabrics, for improvements in the manufacture of the fronts of shirts. Sealed 7th June, 1849; six months.

Thomas Greenwood, of Goodman's-fields, in the city of London, sugar-refiner, and Frederick Parker, of New Gravel-lane, Shadwell, animal charcoal-manufacturer, for improvements in filtering syrups and other liquors. Sealed 8th June, 1849; six months.

William Ironside Tait, of Rugby, in the county of Warwick, printer and bookseller, for an improved method or methods of producing outlines on paper, pasteboard, parchment, papier maché, and other like fabrics. Sealed 8th June, 1849; four months.

George Simpson, of Buchanan-street, in the city of Glasgow, North Britain, civil and mining engineer, for a certain improvement or improvements in the machinery, apparatus, or means of raising, lowering, supporting, moving, or transporting heavy bodies, such improvements being applicable to various useful purposes. Sealed 11th June, 1849; six months.

Joseph Harrison, of Blackburn, in the county of Lancaster, machine-maker, for certain improvements in, and applicable to, looms for weaving. Sealed 11th June, 1849; four months.

William Gratrix, of Salford, in the county of Lancaster, bleacher and dyer, for certain improvements in the method or process of dyeing and finishing woven and other fabrics, and in the machinery or apparatus for performing the same; part of which improvements is applicable to stretching woven fabrics. Sealed 12th June, 1849; six months.

Osgood Field, of London, merchant, for improvements in anchors. Sealed 14th June, 1849; six months.

Robert Nelson Collins, of Oxford-court, Cannon-street, in the city of London, wholesale druggist, for certain improved compounds, to be used for the prevention of injury to health under certain circumstances. Sealed 14th June, 1849; six months.

Francis Alton Calvert, of Manchester, in the county of Lancaster, merchant, for certain improvements in machinery for cleaning and preparing cotton, wool, and other fibrous substances. Sealed 19th June, 1849; four months.

Charles Augustus Holm, of the Strand, engineer, for improvements in printing. Sealed 19th June, 1849; six months.

Thomas Harcourt Thompson, civil engineer, of Blackheath-hill, in the county of Kent, for certain improvements in apparatus for preventing the rise of noxious effluvia from drains, sewers cesspools, and other places; and in apparatus and machinery for regulating the level of water in rivers, reservoirs, and canals. Sealed 22d June, 1849; six months.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF IRELAND, FROM THE 20TH DAY OF MAY TO THE 20TH DAY OF JUNE, 1849, INCLUSIVE.

Elijah Slack, of Orchard-street, in the burgh of Renfrew, North Britain, gum-manufacturer, for improvement or improvements in the preparation of materials to be used in the manufacture of textile fabrics. Sealed 28th May, 1849; six months.

John Bethell, of Parliament-street, in the city of Westminster, for certain improvements in preserving animal and vegetable substances, and also stones, bricks, and articles made of clay, and chalk, and plaster, from decay. Sealed 1st June, 1849; six months.

Alexander Munkittrick, of Manchester, in the county of Lancaster, merchant, for an improved composition of matter, which is applicable as a substitute for oil, in the lubrication of machinery, and for other purposes. Sealed 2d June, 1849; six months.—(Communication.)

Joseph Deeley, of Newport, in the county of Monmouth, engineer and ironfounder, for improvements in ovens and furnaces. Sealed 13th June, 1849; six months.

Robert Brett Schenck, late of New York, in the United States of America, at present of Belfast, in the county of Antrim, manufacturer, for a machine for buffing and scrutching flax, hemp, and other fibrous substances. Sealed 18th June, 1849; six months.

PATENT RECENTLY EXPIRED.

W. Crofts, of Nottingham, machine-maker, for certain improvements in machinery for making figured or ornamented bobbin-net, or what is commonly called "ornamented bobbin-net lace. Patent dated June 26th, 1835. Expired June 26th, 1849.

NEW RAILWAY CARRIAGE AXLE-BOX.—Some experiments have been completed on the London and North-Western Railway. The objection to the ordinary axle-boxes of railway carriages is, that while the grease finds an easy escape from them, and is wasted to an expensive extent, the dust, of which an abundance is raised by the speed of the train, insinuates itself between the axles and the journals, and acts as a grinding medium upon the surfaces of both metals. The consequence is, a considerable wear of materials and frequent "hot axles." To this objection must be added the wages of the men employed at the stations to replenish such of the axle-boxes as have lost an undue quantity of grease. It is seldom that a train runs fifty miles without some of the axle-boxes requiring a fresh supply. The new axle-boxes, which are the invention of one of the officers of the company, Mr. Normanville, prevent the admission of grit by the use of a screw opening, through which the grease is slipped; and the waste of the latter, as well as the insinuation of dust between the axles and the journals, are avoided by the application of a valve acted upon by vulcanized indiarubber springs fitted to the axle at the hitherto open end of the box. The experiments were made with two four-wheeled first-class carriages taken indiscriminately from the rolling stock. One of them ran upwards of 4,000 miles, and the other upwards of 3,800 miles, without the axle-boxes having had any additional grease supplied, and without the axles having once got "hot." At the conclusion of the experiment, the axles and journals were inspected by the company's officers and found to be in perfect order. It is stated that the application of these axle-boxes to the company's stock will effect a saving of several thousand pounds sterling per annum.—*Patent Journal.*

By a series of well-conducted experiments, M. Fresenius has determined that 1,000,000 parts of atmospheric air contain during the day 0.098 parts of ammonia, equal to 0.283 parts of carbonate of ammonia. During the night the same amount of air contains 0.169 ammonia, equal to 0.474 carbonate of ammonia. These results are known to be slightly in error, there being actually more ammonia in the air; they are, however, the closest approximations which have been made.

On the report of Mr. Benton from the select committee of the Senate, the United States Congress have granted the sum of 20,000 dollars to Professor Page to enable him to carry out his experiments on the application of electro-magnetism as a motive power. Many exaggerated accounts of the wonders performed by Mr. Page's machines have appeared in the American papers; but he has not yet done more than has been previously effected by Jacobi, Davidson, and others.

TOOTH CEMENT.—Gum sandarach, 2 drachms; mastic, 1 drachm; amber, 10 grains; ether, 1 drachm. Put the ingredients into a stoppered bottle, and dissolve with the aid of heat.

TO CORRESPONDENTS.

"Mr. White, Bristol."—The gutta percha tubing will answer the purpose exceedingly well.

"R. W. C."—The term "chlorhydric acid" is not used by English chemists, hydrochloric and muriatic being the received terms this side of the Channel. Our correspondent suggests a perfectly novel chemical nomenclature. He would say chlorobinoxous acid instead of chlorous acid, bichloroquinoxic acid for chloric acid, carbobinoxic acid for carbonic acid, bicarboteroxic acid for oxalic acid. We must confess we do not admire the suggestion.

"H."—Will our correspondent favour us with his name and address in confidence?

"Mr. Mitchel, Loughborough."—You are too late. A patent has been obtained already by the parties; and we greatly doubt whether you would gain much by a Chancery suit. In a *moral* point of view the transaction is a most disgraceful one to the parties engaged in it: it falls very little short of actual robbery. The patent laws of this country require a thorough and sweeping reform.

"M.R.C.S."—Concentrated sulphuric acid. Nitric acid will not answer the purpose.

"An Apothecary."—Pay, and have done with it.

"P. S. R., Bristol."—The purity of metallic silver may be determined in the following way:—Dissolve 54 grains of the specimen in nitric acid, and add pure hydrochloric acid as long as a precipitate continues to form. Filter. The filtrate should leave no residue upon evaporation. The precipitated chloride should be soluble in solution of ammonia, and perfectly insoluble in nitric acid. After being washed, dried, and fused, it should weigh 71.75 grains.

"R. T. H."—The acetate of lime is gently heated to destroy its empyreumatic matter without injuring the acetic acid; it is then dissolved and defecated, and subsequently precipitated by a solution of sulphate of soda, when a solution of sulphate of soda and a precipitate of sulphate of lime are formed by double decomposition. The solution is next evaporated to dryness, the dry mass dissolved in water, and the new solution filtered and re-crystallized. The crystals of acetate of soda obtained by this process must be distilled with sulphuric acid in the usual way.

"Iota."—We will endeavour to answer your questions in the course of three or four weeks.

THE CHEMICAL TIMES is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentleman may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary or scientific communications to be addressed to the Editor, 320, Strand.

ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXIV.

(LECTURE XCVII.)

VEGETO-ALKALIS—(*Continued*).

PREPARATION OF MORPHIA AND OF ITS SALTS—(*Continued*).

GREGORY'S (OR ROBERTSON'S) PROCESS.

Extract the soluble parts of a given quantity of opium with cold water, and evaporate the solution to the consistence of an extract; redissolve the latter in water, and evaporate again to the consistence of 10° areom. Add to the liquid, whilst boiling, dry chloride of calcium in the proportion of about 120 grammes for every kilogramme of opium used. (The chloride of calcium must be perfectly free from admixture of iron, since the latter metal would produce with the meconic acid a red-coloured salt, which would greatly impede the purification of the product.)

Mix the liquid, while it is hot, with cold water, whereupon a large proportion of meconate and sulphate of lime will precipitate in conjunction with colouring matter, resin, and oil of opium.

Filter off the liquid, and concentrate the filtrate. A deposit will form, consisting chiefly of meconate of lime. Filter again, wash the deposit on the filter with a little cold water, and add the washings to the filtrate. Evaporate the latter now to the consistence of syrup, and let this stand at rest for a few days, when you will obtain a crystalline mass (consisting of hydrochlorate of morphia and codeia) and a black mother liquor which contains bimeconate of lime, a little morphia, and the narceia, thebaine, meconia, and narcotina of the opium. These divers substances may be obtained from the mother liquor by Couerbe's process ("Annales de Chimie et de Physique," vol. ix.); but it is hardly worth while to take the trouble, and most practitioners throw the mother liquor away as perfectly valueless.

Redissolve the crystalline mass in slightly acidulated water, and evaporate the solution to crystallization. The addition of some acid to the water favours the solution of the colouring matter, and accordingly the salt obtained is whiter. The mother liquor retains a considerable proportion of morphia, which may be extracted from it by the usual process.

Dissolve the crystals again in hot water, saturate the solution with a little chalk, and add animal charcoal. The proportion of water must be sufficient to retain the salt in solution in the cold; the temperature of the menstruum must not exceed 190 Fahr. At the end of twenty-four hours filter the solution, and add to the yellowish filtrate a few drops of acid, which will serve to decolorate it, and will, moreover, favour the crystallization. Redissolve the crystals, and evaporate the solution to crystallization. Press the crystals between sheets of blotting paper, and dry them subsequently in the stove. Subject the mother liquor to the same process (addition of chalk, charcoal, &c. &c.).

The salt obtained by this process is a double hydrochlorate of codeia and morphia. It contains no narcotina, since the salts of the latter alkaloid are uncrystallizable, and remain accordingly in the mother liquors.

Dissolve the double hydrochlorate (called Gregory's salt) in water, boil the solution, and add ammonia, which will precipitate the morphia. Filter. If you wish to have the morphia in the crystalline form, proceed as directed in Lecture XCVI.

Concentrate the filtrate (which retains codeia, hydrochlorate of ammonia, and a little morphia) to crystallization. Redissolve the double hydrochlorate of codeia and ammonia obtained, and concentrate the solution again to crystallization. You will obtain a salt in silky tufts: this is hydrochlorate of codeia mixed, still, however, with a little morphia. Triturate the crystals with a solution of caustic potass, which will dissolve the morphia and precipitate the codeia. The precipitate collects at the bottom of the vessel in form of a viscous mass, which gradually loses its transparency, increases in bulk, and becomes pulverulent. Wash this mass with a little cold water, dry it, and dissolve it subsequently in boiling ether. The ethereal solution, mixed with a little cold water, yields crystals of codeia by spontaneous evaporation.

Care should be taken not to use too much potass in the process, since an excess of that alkali would dissolve the codeia. It is preferable to leave a little morphia in the deposit, since, the latter alkaloid not being soluble in ether, you obtain a larger quantity of codeia, and of equal purity.

Morphia is frequently mixed with narcotina, from which it may be separated by means of ether, in which menstruum narcotina is soluble and morphia not. Or it may be done more economically by means of highly dilute acetic acid, in which narcotina is insoluble. The best way of testing the purity of morphia is to dissolve it in dilute hydrochloric acid, and to add caustic potass to the solution: the morphia will dissolve in an excess of this alkali; the narcotina will not.

Morphia is given medicinally as a sedative; it is administered mostly in the pilular form. According to Magendie its action is less energetic than that of its salts; but, on the other hand, it would appear that its action is more persistent than that of the latter.

Narcotina is not used medicinally now. Very exaggerated notions were formerly entertained respecting its medicinal efficacy. Magendie asserts, however, that, although its action is almost nil when given in solution in acetic acid, the matter is very different when given in oil. Dr. Bally's observations and experiments would seem to militate strongly against this opinion of Magendie's.

With respect to codeia, this alkaloid is said to procure a calm and gentle sleep, which does not leave behind the disagreeable heaviness and dull headache that follow in the wake of the repose procured by morphia. M. Magendie thinks 1 grain of codeia equivalent to $\frac{1}{2}$ grain of morphia. Codeia is given mostly in the pilular form; sometimes in a julep. The hydrochlorate of codeia is said to act more energetically than the pure alkaloid. Some practitioners deny the efficacy of codeia altogether.

SYRUP OF CODEIA.

Take of Codeia, 1 part.
Distilled water, 100 parts.
Very white sugar, 190 parts.

Reduce the codeia to a fine powder by trituration in a glass or porcelain mortar. Mix the powder gradually with the water, and introduce the mixture into a glass matras. Cover this with a piece of perforated parchment, and heat until the codeia is dissolved; add now the sugar, broken in small lumps, and dissolve at a very gentle heat. Let the syrup cool, and, when cold, filter it through paper.

30 grammes of this syrup contain 10 centigrammes of codeia.

SULPHATE OF MORPHIA.

Sulphate of morphia crystallizes in fasciculated needles. It is procured by dissolving morphia in water acidified with sulphuric acid, adding a little animal charcoal to the solution, filtering, and concentrating the filtrate to the consistence of a thin syrup.

Sulphate of morphia is composed of 1 equivalent of morphia, 1 of sulphuric acid, and 6 of water (1 of basic water and 5 of crystallization water).

100 parts of sulphate of morphia correspond to 80 parts of crystallized morphia.

SYRUP OF SULPHATE OF MORPHIA.

Take of Sulphate of morphia, 1 part.
Sugar syrup, 2,500 parts.

Dissolve the salt in a very small quantity of water, and mix the solution with the syrup.

30 grammes of the syrup contain 12 milligrammes of the salt.

HYDROCHLORATE OF MORPHIA.

This salt is prepared in the same way as the sulphate, substituting simply hydrochloric for sulphuric acid.

The hydrochlorate of morphia is soluble in 16 to 20 parts of cold water. It is composed of one equivalent of morphia, and one of hydrochloric acid; in the crystalline form it contains six equivalents = 13.98 per cent.—of water.

100 parts of hydrochlorate of morphia correspond to 81 parts of crystallized morphia.

SYRUP OF HYDROCHLORATE OF MORPHIA.

Take of Hydrochlorate of morphia, 1 part.
Sugar syrup, 2,500 parts.

Dissolve the hydrochlorate in a small quantity of water, and mix the solution with the syrup.

30 grammes of the syrup contain 12 milligrammes of the salt.

HYDRIODATE OF MORPHIA.

Hydriodate of morphia is a white, sparingly soluble salt. From solution in boiling water it crystallizes on cooling.

It is prepared by dissolving two parts of morphia in dilute sulphuric acid, concentrating the solution, adding one part of very pure iodide of potassium, and washing the hydriodate, which precipitates, with a little cold water.

The portion of the salt which is retained in the mother liquor and washings may be obtained by evaporating the fluid to dryness and treating the residue with alcohol.

ACETATE OF MORPHIA.

Add morphia to acetic acid at 3° areom., leaving the acid in excess. Evaporate the solution to dryness at a gentle heat.

It is difficult to obtain the acetate of morphia pure. If a solution of this salt is left to spontaneous evaporation in a stove, the salt suffers decomposition, and is converted into a mixture of morphia, and neutral and acid acetate of morphia. The same species of decomposition takes place during the evaporation of the solution at a gentle heat. It is owing to this that we find the acetate of morphia only imperfectly soluble in water; to effect its solution, the addition of a few drops of acetic acid is always required.

During the evaporation of the acetate the liquor acquires a greyish colour, and the salt retains the same tint. The coloration is deeper if the salt has been prepared with morphia retaining some admixture of colouring matter.

The following process, however, will be found to yield a perfectly soluble and very slightly coloured product:—

Take of Crystallized morphia, 2 parts.
Wood vinegar at 8° areom., 1 part.

Reduce the morphia to a fine powder, add the acid, and triturate the mixture, which will speedily concrete into a mass. At the end of twenty-four hours reduce this to powder, dry in the open air, and keep in a suitable flask.

The acetate of morphia contains one equivalent of morphia, one of acetic acid, and one of water.

100 grammes of the salt represent 88 grammes of the crystallized alkaloid.

SYRUP OF ACETATE OF MORPHIA.

Take of Acetate of morphia, 1 part.
White sugar, 2,500 parts.

Dissolve the salt in a very small quantity of water acidulated with acetic acid; mix the solution with the syrup, and filter.

30 grammes of the syrup contain 12 milligrammes of the salt.

STATEMENT IN CONTINUATION OF THE ONE PUBLISHED IN THE CHEMICAL TIMES OF JULY 7, 1849, SHOWING THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE AIR FROM JULY 1 TO 7 INCLUSIVE, AS INDICATED BY THE EVAPORATION OF WATER FROM TWO COPPER VESSELS OR SCALES, ONE INSULATED AND THE OTHER NOT. ALSO THE READING OF THE BAROMETER, THERMOMETER, DIRECTION OF WIND, AND GENERAL STATE OF THE WEATHER.

July, 1849.	Barometer.		Therm.		Scales.				Wind.		General State of Weather.
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Insulated	Non-Insulated	Morning.	Evening.	
1	30.15	29.95	61	66		25 I.	25	..	SW.	SW.	Fine all day, but overcast in the evening.
2	29.97	30.05	64	65	40 I.	55 I.	95	..	NW.	NW.	Ditto ditto.
3	29.76	29.70	65	64		5 I.	5	..	W.	SW.	Overcast all day; very high wind and slight showers.
4	29.70	29.68	63	60	10 I.	10 I.	20	..	W.	SW.	Overcast morning; fine rest of day.
5	29.83	30.00	61	61	30 I.	40 I.	70	..	NW.	NW.	Fine all day, with large masses of white clouds, which indicate the fall of much rain to windward.
6	30.10	30.10	65	64		10 I.	10	..	SW.	SW.	Fine all day.
7	30.07	30.15	74	72	10 I.	5 I.	15	..	S.	SW.	Ditto.

On the 14th May I informed Mr. Chadwick of the then state of my electrical apparatus as ominous of approaching disease, *which the present vile system of ventilating sewers is calculated greatly to aggravate*, and shortly after the cholera made its appearance. The electrical apparatus now indicates immediately opposite conditions in the air and the earth, and a short time will show whether these will relieve us of the cholera and induce the potato disease.

Westminster-road, July 9, 1849.

Franklin Coxworthy, Author of "Electrical Condition," &c.

ORIGINAL COMMUNICATIONS TRANSLATIONS, ETC.

ON THE MAGNETISM OF STEAM.

By REUBEN PHILLIPS, Esq.*

1. The following investigation has resulted from an attempt made with a view to the better understanding of the relation between electric and magnetic forces, by ascertaining whether the only form of the electric current, the nature of which, principally from the researches of Dr. Faraday, is very completely comprehended, possesses the usual magnetic properties. In this I was baffled (but the way is now open) by an unexpected phenomenon, the nature of which it became of primary consequence to develop, and which forms the subject of the present paper.

2. A little wooden stick was laid across the mouth of a small Bohemian beaker; the stick was placed parallel with the bottom of the glass, and held in its position with sealing-wax: the beaker was 3.5 inches high. A common sewing-needle No. 7, and another No. 8, were magnetized and stuck through a slip of thin card, the north end of one magnet being opposed to the south of the other, the needles being two inches apart. This partially astatic arrangement was suspended from the stick by a single fibre of silk, and the length of the fibre between the points of suspension was one inch. The needles made one vibration in about two seconds. I found if the needles were much more astatic than this they were very subject to slow irregular variations of position, which appeared to proceed from a twisting of the silk arising from changes in its hygrometric or calorific condition. The mouth of the glass was closed with a card cover furnished with a rim.

3. The beaker was now placed on the stage of a microscope and fastened to the triangular bar by means of cork and thread, and a hole about an inch across was cut in the card cover, the centre of the hole being over the point of the uppermost needle; the arm for carrying the optical tube was now brought over the hole, and then the optical tube, fitted with an object-glass, was screwed into its place; the arm came down nearly close upon the card cover, and the tube of the object-glass passed through the cover and stood over the point of the upper needle. The fine adjustment was used to focus the instrument; and, to bring the point of the needle to its right position under the object-glass, I employed the motion of the arm which carried the optical tube, and also that imparted to the whole instrument, by laying hold on the extremity of one of the prongs of the tripod stand and making it describe a small portion of a circle on the table. The point of the needle was viewed by means of a pencil of light thrown from the mirror through the bottom of the beaker. The magnifying power used was about 450 diameters.

4. A micrometer eyepiece was employed, the scale of which formed an angle of about 25° with the edge of the needle to be observed. The optical power of this micrometer corresponded to the third or deepest eyepiece, with which microscopes are generally furnished; because that for such experiments a shallow object-glass is to be preferred.

5. This galvanoscope was sheltered by a rectangular zinc plate, 1 inch thick, bent somewhat into the shape of the smaller segment of the convex surface of a right cylinder, made by a plane parallel to, and at a considerable distance from, its axis. The length of a line drawn perpendicularly from one straight side to the other was 10 inches, and the maximum length of a perpendicular drawn to this line and extending to the nearest point of the zinc was 2.8 inches; in consequence of this curve, the zinc plate could easily be made to stand on end, in which position it was 18.5 inches high. This shield was employed throughout all the following experiments on steam.

6. In order to obtain accurate results, I found it necessary to avoid moving any mass of iron near the galvanoscope, and also to keep moderately still, although the hands and arms could be freely used without affecting the galvanoscope. During these experiments I sometimes observed a very singular effect produced on the magnetic needles: when the steam was turned on, the needle would begin to move across the field of view with a peculiar slow motion; and, when the steam was shut off, it as slowly or more slowly returned to its former position, one of such vibrations occupying half a minute or more. This I at length found was produced by the steam heating the zinc shield; and thus this motion could be produced or avoided at pleasure, and was, I think, sufficiently accounted for.

7. The steam was obtained from a small hydro-electric machine; and the various apparatus for effecting the discharge were screwed into the condenser at the place made to receive the Armstrong's jet. The condenser was always dry, except where I have noted the contrary, and the steam was discharged horizontally towards the north.

8. A galvanic current was sent through a wire in the neighbourhood of the galvanoscope; the wire lay parallel with the needles in the path taken by the steam (9), and acted about equally on both; the wire of course lay about north and south, and the electricity passed along it from north to south, supposing the current to pass through the conducting wire of a voltaic circle from the platinum to the zinc. When the circuit was completed, the needle moved to one side, A, of the field of view from the opposite side, C. Throughout these experiments the motion of the same end of the same needle was always recorded, and the galvanoscope always stood to the east of the current of steam.

9. To a brass jet, 1.8 inch long, was fastened a piece of glass tube, 11.5 inches long and $\frac{3}{20}$ inch diameter inside, and the juncture was made tight, or nearly so, with caoutchouc; the aperture at the end of the brass jet which projected from the condenser (7) was circular, and $\frac{1}{12}$ inch in diameter. The nearest point of the convex surface of the zinc shield was about $\frac{1}{10}$ inch from the glass tube; the stage of the microscope in this and the following experiments came nearly close to the shield. The fibre which suspended the needles was about $1\frac{3}{4}$ inch from the nearest part of a plane drawn through the end of the brass jet, and making a right angle with its bore; the steam was used in this experiment at about 35 lbs. on the inch. Things being so arranged, I found when the steam was turned on that the needle immediately began to move towards C; and by alternately checking the steam and letting it off a considerable swing of the needles was produced; and by reversing the times of letting off the steam the swing of the needles could be again reduced. I had ascertained by previous trials that turning the cock of the boiler without letting off the steam produced no effect on the needles. The experiment was made by screwing a stopcock in the place of the above-mentioned brass jet; and then the cock of the boiler could be worked without letting off the steam, and without affecting the galvanoscope.

10. The galvanoscope was raised a few inches, so that the steam might act principally on the lower side of the undermost needle, instead of acting equally on both as before, everything else being as in the former experiment. When the steam was turned on the needle began to move towards A; and, by alternately shutting off the steam and letting it issue at the corresponding positions of the needle, a vibration through full half of the micrometer was obtained; and then, by making the blasts of steam synchronical with the opposite vibrations of the needle, the motion was checked.

11. The glass tube was now taken away, the galvanoscope lowered as in (9), and the shield and galvanoscope moved horizontally about $\frac{3}{4}$ inch in a perpendicular direction to the path of the steam, which was used at about thirty-five

* Communicated by the Author to "The Philosophical Magazine."

pounds on the inch. Operating as before, I could with this jet of steam more easily obtain the swing, the motion being towards C when the steam was turned on. Water being placed in the Armstrong's condenser produced no alteration in the magnetic effects of the jet of steam.

12. The effect of this jet (11) was much greater than that of the current of electricity of an Armstrong's jet under the most favourable circumstances. The comparison was made in the following manner:—I found that an Armstrong's jet could discharge more steam in a given time than the brass jet (11), also that the electricity produced by the Armstrong's jet could deflect the needle of a galvanometer of the ordinary construction three or four degrees. I then found that a small voltaic arrangement capable of deflecting the needles of the galvanometer 4°, and having a conducting wire lying in the path of the steam, acted far less on the needles of the galvanoscope than the blast of steam from the brass jet (11). Also when an Armstrong's jet was substituted for the brass jet, and water placed in the condenser, I could perceive no difference in the swing, whether the steam passed by the galvanoscope in a highly electrified condition, or whether the electricity was, in a great measure, collected by means of a number of fine points almost as soon as it left the wooden channel. The points were supplied by two small concentric loops of wire-gauze, placed edgeways in the steam at a distance in different experiments of from $\frac{1}{2}$ to $\frac{3}{4}$ inch from the end of the Armstrong's jet. The galvanoscope was as before (11), except that it was placed about $\frac{3}{4}$ inch further from the jet, but at about the same distance from the path of the steam.

13. There is a singular variation which I have sometimes observed in the magnetic effect produced by the steam issuing from an Armstrong's jet; namely, that the action of the steam on the galvanoscope is much stronger when one of the needles is in the same horizontal plane as the central line of the path of the steam, than when the galvanoscope is placed so that the steam may pass equally near to both needles. I have occasionally observed the swing to be five or six times greater in one position than in the other; but sometimes the swing is the same in either position. I have not perceived a similar effect with any other jet.

14. A pewter tube, six feet long, having a bore $\frac{3}{20}$ inch diameter, was coiled up after the fashion of the wire of a galvanometer: it made six convolutions. One end of the tube was jambed on the brass jet (9), and the coil stood horizontally like the coil of a galvanometer; the zinc shield was brought nearly close to the coil, and the height of the galvanoscope was adjusted so that the coil might act on both the upper and lower sides of the lower needle; the steam entered on the upper side of the coil in the same direction as before. By this arrangement I succeeded in producing a marked swing with steam of a very low pressure, I think below 5 lbs. on the inch; but I did not exactly ascertain the amount of this low pressure, because the safety-valve of the boiler is not graduated below 40 lbs. As the pressure rose, the power exerted on the needles became greater; and at 40 lbs. on the inch a few puffs of steam caused the needle to move through the whole length of the micrometer; the motion, when the steam was turned on, being towards C.

15. Instead of allowing the steam to pass continuously through the tube during the whole of each alternate vibration, it was shut off before the vibration was completed. The swing was now much less, showing that it was not the first gust of steam which alone moved the needles; and this agreed with the visible motion of the needle, which manifestly increased in velocity after it began to move.

16. Water being placed in the condenser of the hydro-electric machine did not sensibly alter the force exerted on the needles by the coil.

17. The coil was now attached to the boiler by means of a piece of brass, the steam-way of which was so large that the coil only might be looked upon as opposing the exit of the steam. Various pressures were tried, as the boiler became heated, up to 40 lbs. per inch. A lead pipe was, in this experiment and frequently afterwards, placed at a short distance from the coil to catch the steam and convey it up a chimney, whereas in former experiments it had freely escaped into the apartment; everything else remained as before (14). The needles began to be affected at a very low pressure; and as the pressure increased the swing became certain and steady, the needle moving towards C when the steam was turned on. The intensity of the swing-producing force was, I think, at its maximum at 10-15 lbs. per inch; as the pressure rose the swing was obtained with more difficulty, and at 40 lbs. on the inch no certain swing could be produced. On repeating this experiment at a subsequent period, with steam at 40 lbs. on the inch, a feeble swing was obtained; but in this latter case the coil, instead of being bright, had become covered with a deposit of carbonate of lime.

18. The galvanoscope was lowered until the upper needle was in the same horizontal plane as the undermost side of the upper portion of the coil, and the lower needle was in a horizontal plane which came to about $\frac{1}{4}$ inch below the lower surface of the lower half of the coil. When the steam was turned on the needle made a start towards A; and by shutting off the steam during the next vibration, and repeating these operations two or three times, a considerable swing was obtained; but on attempting to increase this swing by continuing these intermittent operations the swing rapidly diminished. The order in which the jet of steam and its cessation took place was now inverted, which soon produced a very powerful swing, the needle moving towards C when the steam was turned on. The steam was used at from 30 to 40 lbs. on the inch. These rather irregular motions (17, 18) are probably connected with those of the Armstrong's jet (13).

19. The coil was moved through an angle of 180°, the angular motion being performed parallel to a plane forming a right angle to the path of the steam, and the galvanoscope was adjusted so that the interior surface of the coil might act on the lower needle; by this arrangement the direction of the steam as regards the needle was reversed. Many different pressures were observed, from a pound or two on the inch to 40 lbs. As soon as any distinct swing was produced, it was occasioned by the needle moving towards A when the steam was turned on; as the pressure rose, this swing increased until the steam was, I think, about 25 lbs. on the inch, after which the increased pressure only occasioned a somewhat diminished swing.

20. The apparatus (19) was now rather differently disposed: the shield and galvanoscope were moved horizontally about $\frac{3}{4}$ inch, the direction of the motion being perpendicular to the path of the steam; also a piece of an iron gun-barrel, 7 inches long and open at both ends, was fixed to a support, so that the gun-barrel might easily be thrust into or removed from the coil without bearing upon it; the axis of the gun-barrel when placed in the coil formed a right angle to the path of the steam, and was horizontal, and its direction lay not far from east and west; also one end came to $\frac{1}{3}$ inch of the shield opposite to the lower needle of the galvanoscope. This piece of a gun-barrel had been made red hot and slowly cooled, and its magnetism when in the above position was nearly $=0$; the diameter of its external surface at that end which was placed in the coil, in this and the following experiments, was about one inch, and this end was made of iron about $\frac{1}{10}$ inch thick, the other end being thinner. There was a distance of about $\frac{1}{3}$ inch between the nearest upper or lower part of the iron and the respective inside surfaces of the coil.

21. The steam being at 40 lbs. per inch, and the gun-barrel in the coil, five puffs of steam, each puff acting during every alternate vibration of the needles, produced a swing of about 25° of the micrometer; the gun-barrel was now removed, when five puffs of steam, acting as before, produced a vibration of only 10°. This was done many times, and always with the same result. I think better results would have been obtained at a lower pressure than 40 lbs.; for on examining the vibration at various pressures, the iron being in the coil, I found that a considerable swing was produced almost as soon as the water began to boil at the atmospheric pressure; and shortly afterwards, as the pressure rose, the vibrations became very strong, much stronger than at 40 lbs. The point of the needle moved towards A when the steam was turned on.

22. During these last experiments I ascertained that the first puff of steam which passed through the coil when it was cold produced a much greater effect on the galvanoscope than any immediately succeeding puff. This was guarded against by letting off the first puff, then checking the motion of the needles by some inverse puffs, and then proceeding to make the vibration which was to be compared (21).

23. I next endeavoured to find the cause of the strong action of the first puff.

24. The jet and pewter coil (14), instead of being affixed to the boiler, were attached to a copper box, which enclosed about 90 cubic inches, and the shield and galvanoscope adjusted as before (14); air was now pumped into the box until the pressure rose to about 40 lbs. on the inch, and then discharged through the jet as the steam had been. The needles of the galvanoscope were quite unaffected; consequently, air of about the same temperature as the surrounding atmosphere cannot act on a magnet like steam.

25. It now appeared very possible that the increased action produced by the iron arose from its cooling powers; and also that by further cooling the coil a more intense action would be obtained.

26. The apparatus (17) had the coil partly immersed in water, by bringing a copper pan filled with water under it, so that the water might cover the lower portion of the coil; the upper portion of the coil was kept moist by having had some loosely spun cotton twisted about it, the ends of which dipped into the water. The gun-barrel was placed in the coil much as before (20), and was supported without touching the coil; consequently any little alteration, produced by the heat of the steam, in the position of the coil could not move the iron; the gun-barrel lay entirely under water. The steam was used at 35 to 40 lbs. on the inch, as at that pressure a difference of a few pounds did not much affect the galvanoscope. A few puffs of steam made the water about the coil to boil; after which, when the circumstances of the experiment appeared to be very steady, I observed that one puff of steam could move the edge of the needle across the field of view. The gun-barrel was removed, and now two or three puffs of steam, acting through each alternate vibration, could only produce a swing half across the micrometer. A solid brass rod, ·7 inch diameter, and about 6 inches long, being now laid in the place of the gun-barrel, produced no alteration in the swing of the magnetic needles; the brass rod being removed, and the gun-barrel replaced, the motion of the magnets at once became as strong as before. It now follows that the action of the iron on the galvanoscope is independent of any little change of temperature it may produce. The swing was towards C when the steam was turned on.

27. In these experiments I did not perceive any difference between the first and following puffs of steam; and the swing was, I think, at least as great at 40lbs. as at any lower pressure.

28. The brass jet (9) was screwed into the end of the coil from which the steam escaped (26), which apparatus in other respects remained as before; this alteration caused an increased pressure in the coil, and the condensation was consequently very rapid; so much so that what escaped from the brass jet looked more like water than steam. The swing, when the

gun-barrel was either in or out of the coil, remained just as before (26), the pressure in the boiler being about 40 lbs. on the inch.

29. A pewter tube, 9 feet long and $\frac{1}{4}$ inch internal diameter, was made into a dense cylindrical coil 4 inches long, the diameter of the external surface of which was 2.5 inches, and the diameter of the interior 1.25 inch. This coil was attached to the boiler by means of a short brass connecting piece, the steam-way of which was cylindrical, and $\frac{3}{20}$ inch diameter; the coil was supported horizontally, and pointed about east and west. The shield stood $\frac{1}{5}$ inch at its nearest part from the end of the coil, and the galvanoscope was adjusted so that the lower needle was opposite to the coil; the steam circulated in the same direction as before (14, 26). At 40 lbs. four puffs of steam produced a swing about one fourth across the micrometer, and the swing was not very much stronger at any lower pressure. The copper pan, which had previously been placed in position under the coil, was now filled with water, by which the coil was about half covered. The first motions of the needle were not very powerful; but, after three or four puffs, which heated the water about the coil, one puff of steam would move the needle from A quite out at C; the swing was in the same direction when there was no water in the pan.

30. The cylindrical pewter coil had a turn or two opened out, in order to give sufficient length between the brass connecting piece and the coil to allow the latter to be immersed in the water of the copper pan. The gun-barrel was placed in the coil, and was supported by wires attached to the copper pan, and so prevented from touching the coil; the gun-barrel projected about $\frac{1}{2}$ inch beyond the end of the coil on the side nearest to the galvanoscope. The optical tube of the galvanoscope was removed, and the hole in the cover was closed with a piece of glass. The steam was used at about 40 lbs. on the inch. After the water in the copper pan had been heated I could easily by successive puffs of steam produce a vibration through an arc of 20 or 30 degrees.

31. Putting together these gun-barrel experiments, and that with condensed air (24), I come to the conclusion that a difference of temperature is necessary to produce these peculiar magnetic effects; which accounts for the greater force of the first blast of steam (22), and for the superior force of a jet (11). Also the similarity which exists between the magnetic effects of the steam current and the magnetic effects of the voltaic current, both as regards magnets and soft iron, renders it nearly or quite certain that this force of the steam is magnetism.

32. Now, a jet of steam, even when mixed with much water, is an excellent non-conductor of electricity; for, when discharged from an Armstrong's jet, it is seen that electricity even of a very high intensity cannot pass through it, and a jet of dry steam must be at least as good a non-conductor; hence the jet of steam (11) cannot be travelled by any feeble current of electricity, a thermo-electric current for instance. Again, this magnetic effect of the steam must be independent of any electricity carried forward by the steam, as when discharged by an Armstrong's jet; for the greatest amount of electricity which I have been able to obtain from an Armstrong's jet was found sufficient to charge a Leyden jar of about 340 square inches, both sides taken together, twenty-eight times in a minute, the spark being $\frac{1}{3}$ inch long, and the steam at 40 lbs. on the inch. Now, whether the steam passed by the galvanoscope in this highly excited condition, or nearly divested of its electricity, the effect on the galvanoscope was the same, and always many times greater than what could be produced by this largest quantity of frictional electricity that could be obtained (12). Besides, the frictional electricity of steam increases much as the pressure rises from 10 to 40 lbs. (Armstrong, Matteucci). But I have not generally perceived that the swing of the galvanoscope thus increases with the pressure, but rather the reverse. Also Dr. Faraday has shown that dry pure steam (11) cannot develop frictional electricity.

33. From these considerations I conclude that no continuous electric current passes through or by means of the steam jet; however, many very small currents may circulate in it. For instance, if we may suppose that a particle of steam when brought into contact with a particle of colder water develops a momentary current of electricity in a direction bearing some fixed relation to those particles, and then if a continual succession of such particles ensues, the majority of which are similarly placed, we should have something answering to an ordinary electric current, and not very unlike those currents imagined in Ampère's theory of magnetism. This notion accounts for the change in the direction of the magnetism produced by changing the direction of the steam, the effect of the difference of temperature, and the manifest want of equivalency between the steam power expended and the magnetic force obtained. But it may be well to bear in mind that, perhaps, magnetism may ultimately come to be regarded as some function of ordinary matter and the ether. I can only look upon the experiments (12) as going to show that magnetism is not always bound up with current electricity. I should probably have made a decisive experiment on this point, but that the steam apparatus at my disposal was not sufficiently powerful.

34. It is possible instances may be found on board steamers in which the compasses are much disturbed by the steam. Clouds, too, in the act of formation and passing rapidly over a magnet may somewhat affect it.

ON THE INORGANIC CONSTITUENTS OF ORGANIC BODIES.

By H. ROSE,

Professor of Chemistry in the University of Berlin.

[*Continued from page* 42.]

Perhaps it is of importance to distinguish the organic substances, the inorganic constituents of which are contained in them in a completely oxidized or deoxidized state, by separate names.

I shall therefore call those organic substances, the inorganic constituents of which are in a perfectly oxidized state, teleoxidic bodies. Pea-straw and rape-straw, as also even wheat-straw, may be called teleoxidic substances, although they do not deserve this appellation so strictly as many animal bodies, of which we shall speak presently. But those organic substances, the inorganic constituents of which exist partly in an oxidized and partly in an unoxidized state, I shall call meroxidic substances. Peas, rape, and wheat are, therefore, meroxidic substances. I have never met with perfectly anoxidic substances, either in the examination of vegetable or animal substances. It is probable that if the proteine compounds existing in meroxidic substances were isolated as completely as possible they would constitute perfectly anoxidic substances, which after carbonization would not yield any soluble salts to the solvents until these had been produced by complete incineration.

INORGANIC CONSTITUENTS OF ANIMALS.

Animals derive the inorganic constituents which the various parts of their body contain from the food. This is, however, assimilated by them in a totally different manner to that in plants; whilst in the latter, in general, a process of deoxidation occurs, to which the inorganic substances derived from the soil are subjected, in animals the nutritive substances undergo oxidation by the oxygen inspired. They are first converted into blood, and this is conveyed to all parts of the body where reparation must occur. By the oxidation of the nutritive substances, or rather of the matters produced from them, the elevated temperature of the animal body is produced; and, as this is tolerably uniform, the oxidation also must go on equally uniform in the various parts of the body. It is not, however, merely those parts of the body which consist of carbon, hydrogen, nitrogen, and oxygen only, that take part in the oxidation, but undoubtedly also those compounds of the hypothetical phosphuretted radicals with metals which such animals as are not carnivorous derive from the meroxidic substances of vegetable nutritive matters. That portion of them which is not applied to the repair of the body becomes oxidized; the same also occurs with those parts of the body which are repaired. Whilst the carbonic acid of these compounds is expired in the form of carbonic acid, and the nitrogen is converted into ammonia, the phosphorus is oxidized to form phosphoric acid, and the metals combined with the radicals so as to form oxides. The longer these substances have been exposed to oxidation, the more perfectly are phosphates of the metallic oxides formed.

It must follow from this conclusion that the matter first formed by the nutritive substances, the blood, from which the other parts of the body are repaired, may contain completely oxidized salts, since it is generated from meroxidic substances, but must still contain a large amount of the combinations of the hypothetical radicals with metals. Somewhat the same must occur with flesh, the composition of which is the same as that of the blood; but as it is formed from the blood it must contain more oxidized inorganic salts and less deoxidized salts than the blood. But, if oxidation still continues, the inorganic constituents which become perfectly oxidized by the inspired oxygen must finally be removed from the body, as they are of no further use in it. Thus we find, in fact, that the inorganic constituents of the fluid and solid excrementitious matters are in a perfectly oxidized state, and are perfectly teleoxidic substances. Experiments upon the inorganic constituents of the blood, flesh, and the excrements, have completely confirmed these suppositions.

The inorganic constituents of the blood of the ox have been examined by MM. Weber and Merk.

In the blood which was used for this purpose the clot certainly had coagulated from the liquor sanguinis; but they were both carbonized without separation.

Water extracted from the carbonized mass a very large amount of chloride of sodium, carbonate of potash and of soda, and mere traces of phosphate and sulphate of potash.

Muriatic acid removed from it an inconsiderable amount of the phosphates of soda, potash, lime, magnesia, and perphosphate of iron.

The carbonized mass after exhaustion with these solvents yielded, on incineration, the phosphates of soda, potash, lime, and magnesia, with a large quantity of peroxide of iron and a small quantity of silica; it also contained traces of sulphates.

The following are the relative amounts of the inorganic constituents obtained by the three operations:—

In the aqueous solution	3.920 grms.
In the muriatic solution.....	0.389 "
On the incineration of the remainder of the carbonized mass	2.128 "

We thus see that the amount of oxidized salts in the blood is very large. They consist, however, for the most part of salts soluble in water; and of these chloride of sodium, which cannot be considered as an oxidized salt, is the principal constituent, forming more than half of the whole amount of these salts. When this is taken into consideration the quantity of inorganic constituents formed by the incineration of the carbonaceous mass after exhaustion with the solvents is larger than that of the salts contained in the blood. Hence the blood is a meroxidic body.

Flesh (that of the horse) has been examined as to its inorganic constituents by M. Weber.

Water extracted from the carbonized flesh small quantities only of metallic chlorides, and of sulphate of potash, a large quantity of alkaline phosphates, but no alkaline carbonate.

Muriatic acid then dissolved a considerable quantity of phosphates from the mass.

The residual carbonaceous mass yielded an ash which also consisted of phosphates.

The following were the relative amounts of inorganic constituents obtained in the analysis :—

In the aqueous solution.....	3.090 grms.
In the muriatic solution.....	1.262 "
On the incineration of the carbonized mass.....	2.866 "

Hence flesh, like blood, is a meroxidic substance. The latter apparently contains a comparatively larger amount of teleoxidic matter than flesh. But the aqueous solution of the carbonized blood contains nearly 60 per cent. of chloride of sodium, whilst that of the carbonized flesh contained only very small quantities of alkaline chlorides. On taking this into consideration, the quantity of anoxidic matter in the blood is larger than in the flesh, and that of the teleoxidic matter smaller in the blood than in flesh.

The inorganic constituents of the liquid and solid excrementitious substances have been determined by M. Fleitmann.

The extraordinary large amount of salts contained in the urine is well known: they exist in it in a perfectly oxidized state. On evaporating the urine and carbonizing the dry residue, with exclusion of the air, water extracts almost the whole of the salts. On treating the carbonized mass, after exhaustion with water, with muriatic acid, a somewhat considerable amount of phosphates is further dissolved, part of which had been separated by the evaporation of the urine.

The carbonized mass remaining after the action of water and muriatic acid yielded so small a quantity of ash on combustion as to give rise to the supposition that the inorganic constituents obtained in this way had also existed in an oxidized state in the urine, and had merely escaped the action of the solvents in exhausting the carbonized mass. One of the principal constituents of these inorganic substances was silica, which must have been separated on the evaporation of the urine and heating the dry residue, and have thus become insoluble in muriatic acid. The urine may, therefore, be considered as one of the perfectly teleoxidic substances.

The quantities of the inorganic constituents obtained in these operations were as follows :—

In the aqueous solution.....	54.148 grms.
In the muriatic solution.....	5.085 "
On the incineration of the carbonized mass.....	0.352 "

From the carbonized fæces water extracted some chloride of sodium and potassium, a considerable quantity of carbonate and phosphate of potash, a less amount of sulphate of potash, and a very large quantity of free potash.

But the quantity of inorganic constituents dissolved by muriatic acid was very large. It consisted of much phosphate of lime and magnesia, phosphate of potash and soda, a very small amount of sulphate, silicate of potash, and a very small quantity of peroxide of iron.

The exhausted carbonized mass on incineration yielded no very inconsiderable quantities of fixed constituents, the principal of which, however, was silica in the form of sand (sandartige Kieselsäure). It moreover contained a tolerably large amount of lime and magnesia, with a small quantity of phosphate of potash and soda, peroxide of iron and silica.

The relative quantities in the different solutions and in the remaining carbonized mass were as follows :—

In the aqueous solution.....	1.933 grms.
In the muriatic solution.....	6.493 "
On the incineration of the carbonized mass.....	1.996 "

But on deducting from the latter amount that of the silica and sand we only obtain somewhat more than 1 grm., and hence the solid excrements may be considered as belonging to the teleoxidic substances.

Whilst those inorganic oxidized constituents which are soluble in water are separated by the urine, those which are insoluble pass off as fæces. In proportion as digestion in the body goes on in a normal state, and the less the excess of nutritive substances introduced into it, the amount of imperfectly oxidized constituents of the fæces must be less, and the quantity of teleoxidic substances larger. It is, therefore, probable that, by the chemical investigation of the fæces, a conclusion may be formed as to the proper or defective manner in which digestion is carried on. The fact that the inorganic constituents of the liquid and solid excrements, especially the phosphates, exist in them in the oxidized state, is the principal reason of their use as manure, which must be more fit for this purpose in proportion to the amount of teleoxidic substances of which it consists.

As the inorganic substances from animal bodies are added to plants in the form of manure, the process, in which they are first deoxidized and then again oxidized, recommences.

The examination of other parts of the animal body by the method described is of some interest. As regards the bones, it is well known that all their inorganic constituents may be extracted by dilute muriatic acid, so that the cartilage remains in a pure state; likewise, when they have been heated to redness with exclusion of the air, muriatic acid dissolves the inorganic salts and leaves pure carbon. We know that boneblack, as it is called, may be decomposed in this manner.

Thus the bones, like the liquid and solid excrementitious matters, contain the larger amount of their inorganic salts in a perfectly oxidized state, and entirely belong to the teleoxidic substances. This explains the fact that ground bones form one of the best manures.

The bile (ox bile) has been examined by M. Weidenbusch in the same way. Likewise, in this case, the surprising result has been arrived at, that the inorganic constituents, as in the excrements, exist almost wholly in the oxidized state, and that the bile is, therefore, a teleoxidic substance.

By far the larger portion of the inorganic constituents of the carbonized mass of the bile is extracted by water. It dissolves principally the carbonate, phosphate, and sulphate of soda, with chloride of sodium; the quantity of salts of potash dissolved is, however, very small.

Muriatic acid extracted from it a small quantity of phosphate and a trace of silicate. The bases were principally lime, soda, potash, magnesia, and the protoxides of iron and manganese.

The washed residue yielded a very small quantity of ash on incineration, which contained a remarkably large amount of sulphuric acid, and but little phosphates. The bases were principally soda, potash, magnesia, and lime.

The following are the quantities of the inorganic constituents which were obtained in the various operations :—

In the aqueous solution	16.018 grms.
In the muriatic solution	0.869 "
On the incineration of the carbonized residue	0.7445 "

It is thus evident that the inorganic constituents of the bile exist in an almost complete state of oxidation, precisely as in the urine.

The next question is whether the milk is also an excretion, like the urine, and whether the whole of its inorganic constituents exist in a perfectly oxidized state. It appears, however, from M. Weber's experiments upon the milk of the cow that, in addition to numerous perfectly oxidized salts, it also contains a considerable amount of inorganic constituents in a deoxidized state, and is, therefore, a meroxidic substance.

The aqueous extract of the evaporated and carbonized milk contains a large amount of alkaline chlorides, with phosphate and carbonate of potash.

The muriatic extract of the carbonized mass contains a large amount of phosphate of lime, with small quantities of the phosphates of magnesia, potash, and soda.

On the incineration of the exhausted carbonized mass further large quantities of the phosphates of lime, potash, soda, and magnesia were obtained.

The following are the relative proportions of the inorganic constituents obtained in the various operations :—

In the aqueous solution	7.125 grms.
In the muriatic solution	6.621 "
On the incineration of the remainder of the carbonized mass	7.109 "

Thus the milk contains a considerable amount of both oxidized and unoxidized inorganic constituents. It cannot under any circumstances be arranged in the same class as the urine, and, like the latter, be considered as an excretion. It is a meroxidic compound.

In eggs (hens' eggs) the inorganic constituents are in a more oxidized state in the albumen, whilst they are in a more unoxidized state in the yolk, as appears from the experiments of M. Poleck. These experiments, however, were made long ago in my laboratory; the methods adopted were consequently imperfect, and they require repetition. This is the more necessary since the results of these experiments appear to be in opposition to those which have been obtained in almost all the others. For all those meroxidic substances which have been examined, such as peas, rapeseed, and wheat, moreover the blood, flesh, and the milk, contain a large amount of the so-called proteine compounds. In teleoxidic substances, the excrements and the bile, the proteine compounds are entirely absent; and in the straw of peas, rape, and wheat they exist in small quantity only, corresponding to the amount of meroxidic substances found in them. It is probable, therefore, that the proteine compounds, when freed as perfectly as possible from all the teleoxidic substances which accompany them, are in many cases perfectly anoxidic substances. The only results opposed to this view are those obtained by M. Poleck, as regards the albumen of eggs, which contains a small quantity of anoxidic substances.

[*To be continued.*]

EXPERIMENTS RECENTLY MADE AT DEVONPORT FOR THE PURPOSE OF TESTING THE ILLUMINATING POWER OF THE ELECTRIC LIGHT.

By Dr. LETHEBY,

Lecturer on Chemistry at the London Hospital.

[From the *Pharmaceutical Journal.*]

I have no doubt that many of the readers of your journal, who have become interested in the lectures lately published by Professor Redwood on the production, management, and capabilities of the electric light, may feel a pleasure in being further informed on the above subject. I have, therefore, hastily thrown together a few facts which have just been communicated to me by my friend Mr. Hearder, of Plymouth, who, in conjunction with several scientific gentlemen, chiefly officers of the Royal Engineers, has recently made some very satisfactory experiments on the intensity of the galvanic light, and has found that its brilliancy is much greater than is generally supposed.

The light was exhibited from the summit of the Devonport column, a position which enabled the operator to throw the luminous beams over the towns of Plymouth, Devonport, and Stonehouse, and so away to more remote localities. At a distance of about three miles from the column the light, not having any reflector to concentrate it, appeared like a bright blue star; but when its rays were focussed by means of a twenty-one-inch parabolic mirror, kindly lent to Mr. Hearder by the Trinity Board, it threw out a blaze of surpassing brilliancy; for at Trematon Castle, which is situated at a distance of 18,266 feet NN.W. from the column, the light shone with such intensity that the spectators were enabled to see the time by the seconds-

hands of a small watch, and they were also able to read ordinary writing. The ivy-leaves on the castle tower and keep were plainly visible to them at a distance of ninety feet, and persons who were more than half a mile behind the keep could readily distinguish the gravel walks which surround it. "And," says Mr. Tucker, who was appointed to be present at Trematon in order to report on the appearance of the light, "we were all very much pleased by the striking effect produced by your turning the reflector upwards towards the clouds, which we clearly saw; the light then having the appearance of the tail of a huge comet, the reflector being the nucleus. I think I may state that the breadth of the intensity of the light was at least three quarters of a mile." Such were the appearances and effects of the light at a distance of three miles from it.

After the battery had been in action about an hour, Mr. Hearder turned the mirror so as to throw the light in an opposite direction, namely, towards Bovisand, where other scientific friends were waiting to test its power. Now, Bovisand is situated at a distance of 16,470 feet from the column; and Mr. Walker, who was there to report results, states that the light was very intense, and that the shadows of his friends were projected on the yellow door of a boathouse with surprising distinctness; in fact, its effects were pronounced to be equal to those of the full moon when on the meridian during a calm clear night. A candle, six to the pound, projected a similar and equal shadow at a distance of 30 feet; that is to say, the shadow projected by the electric light at a distance of 16,470 feet was equal to that cast by the candle at a distance of 30 feet, consequently their relative illuminating powers are as 301,401 to 1. According to this experiment, therefore, the light is much more brilliant than it is commonly supposed to be, for Mr. Grove has calculated that its intensity is only equal to 1,444 candles instead of 301,401.

Mr. Hearder has further informed me that the battery which he used was a Maynooth, composed of eighty cells of four square inches surface, arranged in two series of forty each, so that he worked with a surface quantity of eight square inches, and an intensity of forty elements. The battery was charged with a saturated solution of sal-ammoniac in the zinc cells, and the usual mixture of sulphuric and nitric acids in the iron ones.

The charcoal points or cylinders were composed of finely-powdered hard coke, from which the iron had been removed by means of a magnet. They were prepared by mixing the powder with a little coal tar, then ramming it hard into an iron tube, in which it was afterwards baked at a white heat for one hour.

With these arrangements Mr. Hearder says that he can easily keep up a constant light for upwards of an hour; and I have no doubt that the brilliancy, steadiness, and duration of the light may be still further increased by soaking the charcoal cylinders in saturated saline solutions; for, in the course of some experiments which I have recently made with a Grove's battery of only twenty cells, I have found that the intensity of the light is doubled by steeping the coke in a strong solution of common salt, whereby I have been enabled to obtain a longer and steadier, as well as a brighter, arc. It is possible also to get coloured lights by soaking the coke in solutions of copper, strontian, potash, &c.

I may in conclusion remark that Mr. Hearder has made use of various kinds of charcoal in the manufacture of his cylinders, but not with the same final success; for those which were made of boxwood charcoal became unmanageably hot soon after the generation of the light, whilst those which were fabricated of lampblack burnt away a great deal too fast, and cylinders composed of animal charcoal evolved the disagreeable fumes of phosphoric acid, &c. He concludes, therefore, that the hard coke from gas-retorts is, after it is deprived of the greater portion of its iron, best suited for the fabrication of the charcoal points.

CHEMICAL TABLES, ARRANGED FOR THE CHEMICAL TIMES,

By GEORGE CALEY, Esquire, 2, Mortimer-terrace, Notting-hill, Kensington.

Table IV.

TABLE OF THE MORE IMPORTANT BINARY COMPOUNDS OF THE METALS AND METALLOIDS, WITH THEIR NAMES, FORMULÆ, ATOMIC WEIGHTS ON THE OXYGEN AND HYDROGEN SCALES, AND THEIR PER-CENTAGE COMPOSITION.

[*Continued from page* 14.]

Names of Compounds.	Formulæ.	Atomic Weights on the Hydrogen and Oxygen Scales. H=1.	O=100.	Per-centage Composition.
Glucinium	G	26.54	331.26	
Oxide (glucina)	$G^2 O^3$	77.12	962.52=G	68.83—O 31.17
Chloride	$G^2 Cl^3$	159.50	1990.48=G	33.29—Cl 66.71
Gold	Au	199.21	2486.03	
Protoxide	AuO	207.23	2586.03=Au	96.13—O 3.87
Peroxide	$Au O^3$	223.25	2786.05=Au	89.23—O 10.77
Bromide	Au Br	276.96	3464.32=Au	71.76—Br 28.24
Perbromide	$Au Br^3$	434.39	5420.94=Au	45.86—Br 54.14
Chloride	Au Cl	234.68	2928.68=Au	84.89—Cl 15.11
Perchloride	$Au Cl^3$	305.62	3813.98=Au	65.18—Cl 34.82
Iodide	AuI	325.77	4065.53=Au	61.15—I 38.85
Periodide	$Au I^3$	578.91	7224.52=Au	34.41—I 65.59
Protosulphuret	AuS	215.33	2687.19=Au	92.51—S 7.49
Tersulphuret	$Au S^3$	247.57	3089.52=Au	80.47—S 19.53
Iron	Fe	27.18	339.21	
Protoxide	FeO	35.19	439.21=Fe	77.23—O 22.77
Black oxide (magnetic)	$Fe^3 O^4$	113.59	1417.61=Fe	71.78—O 28.22
Peroxide	$Fe^2 O^3$	78.40	978.41=Fe	69.34—O 30.36
Protochloride	Fe Cl	62.65	781.86=Fe	43.38—Cl 56.62
Perchloride	$Fe^2 Cl^3$	160.77	2006.36=Fe	33.81—Cl 66.19
Protiodide	FeI	153.75	1918.70=Fe	17.68—I 82.32
Periodide	$Fe^2 I^3$	434.06	5416.91=Fe	12.52—I 87.48
Protobromide	Fe Br	105.57	1317.51=Fe	27.75—Br 74.25
Perbromide	$Fe^2 Br^3$	289.54	3613.33=Fe	18.78—Br 81.22
Protofluoride	FeF	45.92	573.01=Fe	59.20—F 40.80
Perfluoride	$Fe^2 F^3$	110.57	1379.81=Fe	49.17—F 50.83
Subsulphuret (Berzelius)	$Fe^8 S$	233.57	2914.81=Fe	93.10—S 6.90
Disulphuret	$Fe^3 S$	70.48	879.57=Fe	77.13—S 22.87
Sulphuret	FeS	43.30	540.37=Fe	62.72—S 37.23
Sesquisulphuret	$Fe^2 S^3$	102.72	1281.90=Fe	52.92—S 47.08
Bisulphuret (iron pyrites)	$Fe S^2$	59.42	741.54=Fe	45.74—S 54.26
Diphosphuret	$Fe_2 P$	70.08	874.58=Fe	77.57—P 22.43
Tricarburet (Berzelius)	$Fe C^3$	45.56	568.52=Fe	52.59—C 47.41
Quadrocarburet	$Fe C^4$	51.68	644.96=Fe	24.62—C 75.38
Lead	Pb	103.73	1294.50	
Dinoxide	$Pb^2 O$	215.47	2689.00=Pb	96.29—O 3.71
Oxide	PbO	111.74	1394.50=Pb	92.83—O 7.17
Binoxide	PbO^2	119.76	1494.50=Pb	86.62—O 13.38
Minium (red oxide)	$Pb^3 O^4$	343.24	4283.50=Pb	90.67—O 9.33
Sesquioxide	$Pb^2 O^3$	231.49	2889.00=Pb	89.62—O 10.38
Chloride	Pb Cl	139.20	1737.15=Pb	74.52—Cl 25.48
Iodide	PbI	230.30	2874.00=Pb	45.04—I 54.96
Bromide	Pb Br	182.12	2272.80=Pb	56.96—Br 43.04
Fluoride	PbF	122.47	1528.30=Pb	84.70—F 15.30
Sulphuret	PbS	119.85	1495.66=Pb	86.55—S 13.45
Lithium	L	6.44	80.33	
Oxide (lithia)	LO	14.45	180.33=L	44.55—O 55.45
Chloride	L Cl	41.91	522.98=L	15.36—Cl 84.64
Iodide	LI	133.00	1659.83=L	4.84—I 95.16
Bromide	L Br	84.83	1058.64=L	7.59—Br 92.41
Fluoride	LF	25.17	314.13=L	25.57—F 74.43
Sulphuret	LS	22.56	281.50=L	28.54—S 71.46
Magnesium	Mg	12.69	158.35	
Oxide (magnesia)	MgO	20.70	258.35=Mg	61.29—O 38.71
Chloride	Mg Cl	48.16	601.00=Mg	26.35—Cl 73.65
Iodide	MgI	139.26	1737.85=Mg	9.11—I 90.89
Bromide	Mg Br	91.08	1336.66=Mg	13.93—Br 86.07
Fluoride	MgF	31.42	1392.15=Mg	40.38—F 59.62
Manganese	Mn	27.72	345.89	
Protoxide	MnO	35.73	445.89=Mn	77.57—O 22.43
Sesquioxide	$Mn^2 O^3$	79.47	991.71=Mn	69.75—O 30.25
Binoxide (black oxide)	$Mn O^2$	43.74	445.89=Mn	63.86—O 36.64
Red oxide	$Mn^3 O^4$	115.20	1437.66=Mn	72.18—O 27.82
Manganic acid	$Mn O^3$	51.75	645.89=Mn	53.55—O 46.45
Permanganic acid	$Mn^2 O^7$	111.52	1391.71=Mn	49.70—O 50.30
Chloride	Mn Cl	63.19	788.54=Mn	43.86—Cl 56.14
Perchloride	$Mn^2 Cl^7$	303.73	3790.33=Mn	18.25—Cl 81.75
Fluoride	MnF	46.45	579.69=Mn	59.67—F 40.33
Sulphuret	MnS	43.84	547.05=Mn	63.23—S 36.77

TABLE IV.—(*Continued.*)

Names of Compounds.	Formulæ.	Atomic Weights on the Hydrogen and Oxygen Scales. H=1.	O=100.	Per-centage Composition.
MERCURY	Hg	101.43	1265.82	
Suboxide (black oxide)	Hg^2 O	210.88	2631.65	=Hg 96.20—O 3.80
Oxide (red or peroxide)	HgO	109.45	1365.82	=Hg 92.68—O 7.32
Subchloride (calomel)	Hg^2 Cl	238.33	2974.30	=Hg 85.12—Cl 14.88
Chloride (perchloride)	Hg Cl	136.90	1708.47	=Hg 74.09—Cl 25.91
Subiodide	Hg^2 I	329.43	4111.14	=Hg 61.58—I 38.42
Iodide (periodide)	HgI	228.00	2845.32	=Hg 44.49—I 55.51
Subbromide	Hg^2 Br	281.26	3509.95	=Hg 72.13—Br 27.87
Bromide	Hg Br	179.82	2244.13	=Hg 56.41—Br 43.59
Subsulphuret	Hg^2 S	218.92	2732.81	=Hg 92.64—S 7.36
Sulphuret (persulphuret)	Hg S	117.55	1466.99	=Hg 86.29—S 13.71

[*To be continued.*]

SOME FACTS RELATIVE TO THE SPHEROIDAL STATE OF BODIES, FIRE-ORDEAL, INCOMBUSTIBLE MAN, &c.

By P. H. BOUTIGNY, of Evreux.

In the year 241, Sapor or Chapour ordered the Magi to do all in their power to persuade them and bring them back to the faith of their ancestors. It was then that one of the pontiffs of the dominant religion, Adurabâd-Mabrasphand, offered to submit to the fiery ordeal. . . . . "He proposed that eighteen pounds of melted copper, issuing from the furnace, all hot, should be poured on his naked body, on condition that, if he was not injured by it, the unbelievers should yield to so great a miracle. The trial was said to be attended with such success that they were all converted." The historian adds, with an air of doubt, certainly allowable in such a matter, "We see that the religian of Zoroastre had also its miracles and its legends."*

Now, this fiery ordeal, undergone with such success by Adurabâd-Mabrasphand, is in plain truth an experiment of primitive facility and simplicity, and which is anything but miraculous.

I stop here an instant, for I fancy that I see the smile of incredulity rise on the lips of some who do me the honour of listening to me;—that smile, so discouraging to one who is insincere, but which only heightens the ardour of him who intends to practise no deception, and who does all in his power not to deceive himself.

To such persons, then, I would offer this encouragement; the little that I have still to relate appears improbable, but it is true, and that is enough. Having said this, I continue.

In France, in England, in Italy, wherever I have had occasion to speak of bodies in the spheroidal state, I have met with persons who have put to me this question: May there not be some connection between these phenomena and that presented by men who run barefooted over liquid metal (?) still incandescent, or who plunge their hand into molten lead, &c.?† To all I have answered yes, I believe that there is an intimate relation between all these facts and the spheroidal state. And then, in my turn, I put this question: Have you witnessed the fact which you tell me? And the answer has invariably been in the negative.

I avow that all these on-dits and the marvellous legends which I had read in various works‡ on the fiery ordeal and incombustible men, admitted without reserve by some, obstinately denied by others, excited my curiosity greatly, and gave me a great desire to verify all these phenomena, and to recal them to the recollection of contemporary observers; for, alas! all this is as old as the world; *nil sub sole novum.*

I wrote first to my friend Dr. Roché, who passes his life in the midst of the blast furnaces of the Eure, and who is the physician of a portion of the Cyclopean population who feed them. I requested of him precise particulars. All that he could ascertain was that a man named La Forge, of from thirty-five to thirty-six years of age, very corpulent, walked step by step barefooted on the pigs after the casting; but he had not seen this. This was not enough to dispel my doubts.

I then applied to a foundry at Paris, where I was laughed at and shown the door. I retired, hanging down my ears, thinking over the difficulties of verifying a single fact, and such a simple one.

Subsequently I was fortunate enough to meet with M. Alph. Michel, who lives in the midst of the forges of Franche-Comté. M. Michel promised me, with the greatest kindness, to inquire into these facts, and to report upon them if desired.

The following is an extract from the letter which he did me the honour to write to me, dated the 26th of last March:—

"On my return home I did not fail to obtain information from the workmen of the facts of the case (the immersion of the finger in the incandescent melted metal), and most of them laughed in my face, which did not deter me. Lastly, being one day at the forge of Magny, near Lure, I put the question again to a workman, who answered that nothing was more simple; and, to prove it, at the moment when the metal in a state of fusion issued from a Wilkinson, he passed his finger into the incandescent jet. A person employed in the establishment repeated the experiment with impunity; and I myself, emboldened by what I saw, did the same. . . . I may observe that, in making this trial, none of us moistened his finger.

"I hasten, sir, to acquaint you with this fact, which seems to support your ideas on the globular state of liquids; for the fingers being naturally more or less humid, it is, I think, to this moisture passing to the spheroidal state that we must ascribe their momentary incombustibility."

The following are the experiments which I have made:—

I divided or cut with my hand a jet of melted metal of five to six centimetres, which escaped by the tap; then I immediately plunged the other hand in a pot filled with incandescent metal, which was truly frightful to look at. I involuntarily shuddered. But both hands came out of the ordeal victorious. And now, if anything astonishes me, it is that such experiments are not quite common.

I shall of course be asked what precautions are necessary to preserve oneself from the disorganizing action of the incandescent matter? I answer, none;—only to have no fear, to make the experiment with confidence, to pass the hand rapidly, but not too rapidly, in the metal in full fusion.

Otherwise, if the experiment were performed with fear, or with too great rapidity, the repulsive force might be overcome which exists in incandescent bodies, and thus the contact with the skin be effected, which would undoubtedly remain in a state easy to understand.

To form a conception of the danger there would be in passing the hand too rapidly in the metal in fusion, it will suffice to recollect that the resistance is proportionate to the square of the velocity, and, in so compact a fluid as liquid iron, this resistance increases certainly in a higher ratio.

The experiment succeeds especially when the skin is humid; and the involuntary dread which one feels at facing these masses of fire almost always puts the body into that state of moisture so necessary to success; but by taking some precautions one becomes veritably invulnerable. The following is what has succeeded best with me:—I rub my hands with soap, so as to give them a polished surface; then, at the moment of making the experiment, I dip my hand into a cold solution of sal-ammoniac saturated with sulphurous acid, or simply into water containing some sal-ammoniac, and, in default of that, into fresh water.

Regnault, who has occupied himself with this subject, says:—"Those who make a trade of fire handling and holding it in the mouth sometimes employ an equal mixture of spirit of sulphur, of sal-ammoniac, of essence of rosemary, and onion-juice"—all volatile substances, we see, which, in evaporating, render a certain portion of heat latent.

Let us now seek the rational explanation of these facts.

We have the formula $m\ c\ t$, which gives the quantity of heat contained in any body.

Let m be the mass expressed in kilogrammes,
c the specific heat of the body,
t its temperature.

But here the factor m must be excluded from the calculation, because there is no contact between the hand and the metal in fusion, and the experiment presents no difference whether it be made with 10 kilogrammes of metal, or with 1,000 kilogrammes. The sensation which is felt is the same in either case, and this is readily conceived, knowing the repulsive force of incandescent surfaces which is opposed to the contact of any body.

The finger or the hand is then isolated in the midst of the mass in fusion, and thus preserved from the disorganizing action of the incandescent matter.

There remain the two factors c, t. I will suppose, and it is a sufficient approximation, that the value of $c=0.15$, and that of $t=1500$ degrees, the temperature of the metal in fusion; now the product of 1500 degrees $\times 0.15=225$. Thus the epidermis of the experimenter would only be exposed to 225 degrees of heat. Undoubtedly this is a respectable quantity of caloric, but it is too high, as we shall see.

There is no contact between the hand and the metal; this, in my estimation, is a fact positively established. If there is no contact, the heating can only take place by radiation, and it is enormous, it must be acknowledged; but if the radiation is annulled by reflexion, and it is so, it is as if it did not exist, and, definitively, the operator is, so to say, placed in normal conditions.

I think that I have established, a long time ago, the fact that water in the spheroidal state has the property of reflecting radiating heat,* and that its temperature never attains that of its ebullition; whence it follows that the finger or the hand, being humid, cannot rise to the temperature of 100° Centig., the experiment not continuing long enough to permit the humidity to evaporate entirely.

To recapitulate what I have stated on this point, I say, in passing the hand into any metal in fusion, it becomes isolated; the humidity which covers it passes into the spheroidal state, reflects the radiating caloric, and does not become heated enough to boil. This is all.

* "Dictionnaire Historique, Critique et Bibliographique," t. xxvii., p. 417.

† I have alluded to these facts in the work entitled "Nouvelle branche de Physique, or Études sur les Corps à l'État Sphéroïdal," p. 36.

‡ "Des Erreurs et des Préjugés répandus dans les diverses classes de la Société," t. xii., p. 183.

* Nouvelle branche de Physique, or Études sur les Corps à l'État Sphéroïdal, pp. 24 *et seq.* and 132 *et seq.* See also our two letters to the Académie des Sciences, dated the 14th and 21st of July, 1845. In the places indicated will be found the explanation of this phenomenon.

I was right, then, in saying at the outset, this experiment, dangerous in appearance, is almost insignificant in reality.

I have often repeated it with lead, with bronze, &c., and always with the same success.*—*Comptes Rendus*, Mai 14, 1849.

ON THE COMPOSITION OF BONE EARTH.

By Dr. W. HEINTZ.

It has hitherto been generally admitted, according to an analysis by Berzelius, that the phosphate of lime contained in bones has the composition 8CaO, $3PO^5$; a few chemists have expressed a different opinion; however, it is in general a mere supposition, or not supported by satisfactory experiments. To decide the question, the author made the following analyses:—The bones, broken into small pieces, were first deprived of all soluble salts by means of water, and then reduced to a fine powder. A portion of this powder was employed for the determination of the carbonic acid; another portion was carbonized, the cinder exhausted with muriatic acid, then burnt, and the small imponderable quantity of ash added to the acid solution. The liquid, strongly concentrated by evaporation, was supersaturated with a large excess of carbonate of soda, evaporated to dryness, and the residue fused, in order to convert any pyrophosphoric acid that might have been formed into the ordinary modification of this acid. The fused mass was then dissolved in muriatic acid, and the lime, phosphoric acid, and magnesia were determined according to known methods. Three analyses were made in this way; the fourth was slightly modified, inasmuch as the bone powder was exhausted with muriatic acid without having been previously carbonized, so as to avoid the objection that, in the carbonization of the bones, a small quantity of the phosphoric acid may have been decomposed and have been lost. The following are the results of these analyses:—

	Bone of Ox.	Bone of Sheep.	Human Bone.	
Lime	37.46	40.00	37.89	37.51
Magnesia	0.97	0.74	0.57	0.56
Phosphoric acid .	27.89	29.64	28.27	28.00
Carbonic acid ..	3.10	3.08	2.80	2.81
Water, fluorine, and organic matter	30.58	26.54	30.47	31.12

Or if we assume the carbonic acid to be combined with the lime, and the phosphoric acid with the magnesia and lime, and indeed with the greatest possible amount of these bases, we have:—

	Bone of Ox.	Bone of Sheep.	Human Bone.	
Carbonate of lime	7.07	7.00	6.36	6.39
Phosphate of magnesia ..	2.09	1.59	1.23	1.21
Phosphate of lime	58.30	62.70	60.13	59.67
Lime.....	1.96	2.17	1.81	1.62
Water, fluorine and organic substance ..	30.58	26.54	30.47	31.11

It is evident, therefore, from these analyses, that the amount of the bases in the bones exhausted with water is greater than the acids contained in them are capable of combining with. The question then arises, whether other acids do not exist in it besides the carbonic and phosphoric acids. The author could not detect muriatic or sulphuric acid in the cold-prepared nitric extract of bones which had been previously exhausted with water and then carbonized; but he succeeded in detecting the presence of fluorine in it, confirming in this respect the statements of Berzelius, Frerichs, and Erdmann; and he was therefore inclined to assume that the excess of lime may have been combined with the fluorine, which, on evaporating the muriatic solution, must have escaped for the greater part in the state of hydrofluoric acid. According to the analyses of Berzelius, a human femur contains 3.0 per cent. and the bone of an ox 4.5 per cent. of fluoride of calcium in 100 parts of the fixed constituents. Marchand found 1 per cent. fluoride of calcium in human bone, corresponding to 1.6 per cent. of the bone ash.

The author endeavoured to determine the amount of fluoride of calcium contained in the human bones used for the above analyses. He found 2.05 per cent. fluoride of calcium, corresponding to 2.97 per cent. of the bone ash. If the amount of fluoride of calcium be calculated from the quantity of lime contained in the human bones beyond that required to saturate completely the phosphoric and carbonic acids, we find 3.57 and 3.24 per cent. of their ash. This agrees so closely with the amount directly found, that we are led to the conclusion that the inorganic constituents of bones must contain, along with neutral carbonate of lime and fluoride of calcium, phosphate of lime and magnesia, having the composition represented by the formula 3RO, PO_5; and that Berzelius's statement, according to which the lime salt has the composition 8CaO, $3PO_5$, is incorrect. If, for instance, this last composition were correct, the excess of lime would be so great that the bones would appear to contain more than 7 per cent. of fluoride of calcium. The quantity of the fluoride of calcium in bone ash would even exceed 10 per cent. So great an amount of this salt has never been detected in it, and can therefore not be admitted. We are consequently justified in admitting that the phosphate of lime is contained in bones of the form 3CaO, PO_5.

The author has likewse found that bones which have been exhausted with water contain not a trace of iron. In those cases, therefore, in which it has been detected it must have arisen from colouring matter of the blood, which can be completely removed from the bones by cold water, and is, therefore, not an essential constituent of the fixed principles of bones.—*Berlin Berichte.*

* The experiments on the cast iron were made in the foundry of M. Davidson, at La Villette; and on the bronze in that of M. Nérat, Rue Pierre-Levée. I am happy to have an opportunity of publicly thanking these gentlemen for their kind assistance.

ON THE ARTIFICIAL FORMATION OF MINERALS IN THE HUMID WAY.

By M. DE SENARMONT.

Many mineral species very nearly approach some compounds obtained by the usual processes of chemistry, and even supply the deficiencies which are still left in certain natural series. Such, for example, are the carbonates of magnesia, of protoxide of iron, manganese, nickel, cobalt, and zinc, which are placed near rhombic carbonate of lime, and are met with in nature in a state of purity, or of isomorphic union, yielding hybrid species, forming connecting links between pure species.

These natural compounds, which have not been hitherto formed artificially, could not evidently have arisen under the usual conditions of laboratory experiments; for we have no reason for supposing that the same causes could produce different effects at different epochs. It is therefore a subject of great interest to determine with precision the circumstances necessary to the production of all minerals; and the solution of this question would undoubtedly be the best method of raising the veil behind which are hidden the phenomena which attended the formation of a great number of rocks and of a part of the terrestrial globe.

Some happy synthetical attempts have already afforded valuable data on this head. MM. Mitscherlich and Berthier have obtained several fusible minerals in the dry way, and M. Ebelmen has made an additional step in his researches on the formation of infusible silicates and aluminates. M. G. Rose has ably examined the conditions under which carbonate of lime is precipitated in the state of aragonite; lastly, the beautiful experiment of M. Haidinger has thrown great light on the controverted question of the formation of dolomites and the general problem of metamorphism.

The author conceived the idea of forming certain mineral species in the humid way, and his first essays were mode with the carbonates. As it is clearly demonstrated that heat generally favours dehydration, it occurred to the author that the formation of neutral carbonates might be a simple question of pressure and temperature; but, before attempting to precipitate them by the disengagement of the excess of carbonic acid serving them as a solvent at a high temperature under strong pressure, the author attempted double decompositions in the humid way. These first attempts set out, therefore, from the beautiful experiments of M. Haidinger.

The substances were exposed to each other in glass tubes, hermetically sealed, after having exhausted them. If they were of a kind to react upon each other immediately, they were at first separated, and were then, by turning, moved at the proper time. For high temperatures the tubes were enclosed in a gun barrel, hermetically sealed and half filled with water, so as to equalize as much as possible the internal and external pressures on the glass tube. The tubes were heated in small closed chambers in the furnaces of a gas-work.

The following mineral species were by these means produced:—

Carbonate of Magnesia.—By the double decomposition of sulphate of magnesia and carbonate of soda, at about 322° Fahr. It was in the state of white crystalline sand, which was scarcely acted upon by weak acids. Having understood, during the course of his experiments, that M. Maurignac had performed analogous experiments on the reaction of chloride of magnesium and carbonate of lime, hereafter to be described, the author did not proceed further.

Carbonate of Protoxide of Iron.—Obtained by double decomposition: first, of sulphate of protoxide of iron and carbonate of soda, at about 302° F. and above; second, from protochloride of iron and carbonate of lime, at temperatures between 266° F. and 392° F., kept up during twelve, twenty-four, and thirty-six hours. The carbonate of iron was in the state of crystalline sand, of greater or less fineness, of a greyish-black colour, nearly unalterable in dry air, very slowly acquiring a flaxen colour in moist air, and scarcely acted upon by diluted acids. This crystalline sand has then all the properties of spathose iron ore. Its grey colour is more or less dark, and its spontaneous alterability is the smaller according as it is formed at high and long-continued temperatures. Perhaps to circumstances of this kind may be attributed the differences which exist in this respect among natural spathose iron ores; differences which are not sufficiently explained by variation in their composition.

Carbonate of Manganese.—Obtained by double decomposition: first, of chloride of manganese and carbonate of soda, at about 320° F.; second, chloride of manganese and carbonate of lime, at temperatures between 284° F. and 338° F., kept up twelve and forty-eight hours. It is in the state of a fine white powder, slightly rose-tinted, no crystalline appearance, and is unalterable at a moderate heat.

Carbonate of Zinc.—Obtained under the same conditions as that of iron; it is a fine white powder, not crystalline, unalterable at a moderate heat.—*Comptes Rendus*, Juin 4, 1849.

SEPARATION OF GOLD FROM OTHER METALS.—M. Elsner, while engaged on this subject, discovered that protosulphate of iron could not be employed to produce a perfect separation of the gold in a solution containing other metals from which we wish to separate it. But zinc completely separates all the gold; nevertheless, as zinc also precipitates other metals, it is necessary in that case to have recourse to a process allowing of the separation of the gold from the other metals precipitated at the same time.

THE CHEMICAL TIMES.

SATURDAY, JULY 14, 1849.

THE VENTILATION OF SEWERS.

Some fifteen or eighteen months ago the commissioners of sewers, desirous to devise some means of effecting the ventilation of the metropolitan sewers, hit upon the remarkable expedient to effect the purpose in view by means of openings made in them.

This plan was most extensively acted upon: the result was, as might have been foreseen, a considerable increase in the evolution of noxious gases from these receptacles of nightsoil and putrid animal and vegetable matter, and a diffusion of these most deleterious exuviæ over a large surface, particularly on the southern bank of the Thames, where the destructive influence of the noxious gases escaping from the artificial openings in the sewers made itself speedily felt by the generation of typhus and other epidemic diseases—to such an extent, indeed, that the inhabitants of several of the most populous parishes urged upon the parochial authorities the propriety of convening public meetings for the purpose of taking into consideration this most undesirable state of things, and the means of remedying it.

A meeting of this kind was held on the 1st of August, 1848, at the Parochial and National School Rooms, Borough-road, Southwark. It was convened principally at the requisition of twenty-six medical men, resident in the district. The requisition was conceived in the following terms:—

"TO THE CHURCHWARDENS AND OVERSEERS OF THE PARISH OF ST. GEORGE THE MARTYR, SOUTHWARK.

"We, the undersigned inhabitants of the above parish, fully impressed with the importance of a strict observance being maintained of the principles that influence the Legislature of this kingdom in granting sanitary reform, and which are so forcibly expressed by Mr. Chadwick, one of the members of the metropolitan sewers commission, 'that all smell from sewers, if it be intense, is attended with immediate acute disease, and that eventually by depressing the system, and rendering it susceptible to the action of other causes, all smell is disease;' and having observed, therefore, with concern and dismay the system that is now being pursued, of allowing the noxious compounds of putrefaction, generated in the sewers of this vast metropolis, freely to mix with the atmosphere we breathe, request you will take the necessary steps to convene a public meeting in this parish, in order to consider what measures should be adopted to put a stop to a nuisance in every respect calculated to engender an unusual amount of sickness and disease."

The meeting was most numerously and respectably attended. Mr. Churchwarden Archer took the chair. Dr. Barlow, of Union-street, Borough, expressed himself as follows on the subject for the consideration of which the meeting had been convened:—

"I gladly avail myself of this opportunity of expressing the strong objections which I entertain towards the present system of ventilating the drains.

"It is a fact acknowledged by all who are conversant with the action of gascous poisons upon the human frame that the power with which such agents act is dependent mainly upon the degree of concentration or dilution in which they may exist in the atmosphere at the time at which any one may be exposed to them.

"Now, it is evident that, according to the plan now pursued, there is at times a great body of noxious gas almost suddenly evolved, and which, being on that account concentrated, must therefore have a most pernicious effect upon all who may be exposed to it. And, although I am not prepared to say that such gases can generate typhus fever or other epidemic disease, I have no hesitation in affirming that they place the system in that condition which is most favourable to the reception of such diseases; and, further, render it less able to withstand the depressing influence of those diseases after they have been excited."

The meeting finally passed the following resolutions:—

"That fully concurring in the opinions expressed by Mr. Edwin Chadwick (now one of the commissioners of sewers for the metropolis), in his evidence before the select committee of the House of Commons, on the Metropolitan Sewage Manure Company's Bill, viz., 'That all smell from sewers, if it be intense, is attended with immediate acute disease, and that eventually by depressing the system, and rendering it susceptible to the action of other causes, all smell is disease,' this meeting views with alarm the plan adopted by the metropolitan commissioners of sewers for the ventilation of sewers, by which the noxious gases formed in the process of putrefaction in those receptacles of nightsoil and other animal and vegetable matter are emitted in a concentrated form, and mix with the atmosphere in dangerous proximity, both to residents and passengers.

"That it is the opinion of this meeting that unless the openings in the sewers recently made by order of the metropolitan commissioners of sewers be closed, and some simple and efficient plan of ventilating the sewers be adopted, such, for instance, as that which Mr. Franklin Coxworthy has explained to this meeting, the most appalling consequences must inevitably follow, in the general deterioration of the health of the inhabitants, and the increased destruction of life.

"That the officers of this parish be requested to forward copies of the resolutions passed this day to the metropolitan commissioners of sewers, and respectfully to urge upon them the propriety of their causing the nuisance and danger complained of to be immediately remedied, either by the plan submitted to this meeting, or some other equally or more efficient mode; and that the officers of this parish be also requested to communicate these proceedings to the parochial officers of the metropolitan district, in the hope of their general co-operation."

These resolutions were communicated to the metropolitan commissioners of sewers, and their receipt was acknowledged. Some time after a meeting was held in the parish of Christchurch, the parish adjoining that of St. George the Martyr. Mr. Coxworthy attended by invitation, and explained to the meeting, in the presence of an officer deputed by the commissioners of sewers, the nature of his plans of ventilation. A deputation was appointed to wait on the Earl of Carlisle, and instructed, *inter alia*, to recommend Mr. Coxworthy's plans to the serious consideration of the commissioners. This deputation, however, the earl *refused to receive*, and there the matter ended.

Mr. Coxworthy wrote subsequently to the commissioners of sewers, again requesting their attention to his plans of ventilating the sewers. The letter remaining without acknowledgment, he wrote, on the 14th of May, to Mr. Chadwick, the directing member of the board, enclosing a statement of the results indicated by his electric apparatus, and which statement we published in our number of June 9. In this communication to Mr. Chadwick, Mr. Coxworthy observed:—

"As this instrument shows, beyond all question, that the electrical condition of the atmosphere is on the decrease, as you will observe on reference to the accompanying statements for the first four months of the year from 1846 to 1849 inclusive, it will satisfy you, I trust, that my concern respecting the present want of ventilation in the sewers is not without cause, as should any prevailing complaint visit the metropolis its effects must necessarily be most disastrous."

The letter shared the fate of its predecessors.

Shortly after the cholera made its appearance.

Mr. Coxworthy's plan consists in the use of shafts and iron pipes, armed at the top with electrical points, through which the light gases generated in the sewers shall have a free escape to the upper regions, without polluting the atmosphere we breathe—the shafts in all cases being carried higher than the tops of the houses.

The electrical points are intended to throw the atmosphere of the sewer itself into a positively electric state, to prevent its present baneful influence (apart from smell) on the atmosphere of the streets, and, by throwing the ponderable gases, such as the sulphuretted hydrogen, into their natural electrical condition, to cause their descent to the bottom of the sewer, there to become precipitants to the salts held in solution by the water.

Mr. Coxworthy has also offered suggestions for the collection of the filth of sewers; but this question is altogether unconnected with that of ventilation, it being evident that, whatever plan of drainage may ultimately be decided on, the slope provided for the descent of the water must afford an ascending channel for the gases, as the water of the sewer and the foul gases generated must travel in opposite directions.

We must confess Mr. Coxworthy's plans and suggestions appear to us calculated to effect the purpose which they aim at in a much more effective and much less objectionable manner than the present vile system, or, indeed, any other plan that we have heard of as yet. The treatment which that gentleman's suggestions appear to have received at the hands of the commissioners of sewers, and more especially of Mr. Chadwick, is somewhat cavalier, and not calculated precisely to give the public any very exalted notion of the zeal with which the commissioners are devoted to the performance of their duties. The chairman of the board, Lord Ebrington, expressed some years ago a favourable opinion of Mr. Coxworthy's plans of ventilation, and regretted that they should not have received at the hands of the Government the attention which they deserved. This was in June, 1845, when the Whigs were *out* of office. In 1849, when Lord Ebrington happens to be placed in the most favourable position to act upon the opinion which he expressed four years ago, he even omits to acknowledge the receipt of a communication on the subject sent to him in his official capacity. We look upon this conduct as a flagrant neglect of duty, and scarcely less reprehensible than the refusal of Lord Carlisle to receive a deputation on the part of a populous parish. Nor can we admire the *tameness* with which the parochial authorities

seem to have submitted to the insult thus put upon them by the Chief Commissioner of Woods and Forests, who, as a salaried officer of the state, is, in our opinion, bound at least to take cognizance of complaints and suggestions concerning one of the most important branches of his department.

The question is of too vital importance to be permitted to rest. Something *must* be done, and that *speedily* too, to put a stop to the present vile and most pernicious system of ventilating the sewers. It is notorious that there are forty houses unoccupied in Stamford-street, and that the shops and houses in the Blackfriars-road are beginning to share a similar fate, the inhabitants being positively driven away by noxious exhalations from the sewers. We would suggest the immediate convening of a Borough meeting to take this matter into serious consideration.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

May 24.—The Earl of Rosse, president, in the chair.

An appendix to a paper, "On the Variations of the Acidity of the Urine in the State of Health,"* "On the Influence of Medicines on the Acidity of the Urine," by Henry Bence Jones, M.D., M.A., F.R.S., &c.

The variations of the acidity of the urine in the state of health having been shown in the original paper, and the effect of dilute sulphuric acid also traced, in this appendix the influence of caustic potash, of tartaric acid, and of tartrate of soda, on the acidity of the urine is determined.

One ounce of liquor potassæ, specific gravity 1072, was taken in distilled water, in three days. It hindered the acidity of the urine from rising long after digestion to the height to which (from comparative experiments) it otherwise would have done; but it by no means made the urine constantly alkaline; nor did it hinder the variations produced by the state of the stomach from being very evident.

354 grains of dry and pure tartaric acid dissolved in water were taken in three days. The conclusion from the observations is that this quantity increased the acidity of the urine, but during that time it did not render the effect of the stomach on the reaction of the urine less apparent than when no acid was taken; and, therefore, that this quantity of tartaric acid, during this time, does not produce so much effect on the reaction of the urine as the stomach does.

Tartrate of potash in large doses produces the most marked effect on the alkalescence of the urine. 120 grains of pure dry tartrate of potash dissolved in four ounces of distilled water made the urine alkaline in thirty-five minutes. In two hours the alkalescence had disappeared, but after the next meal the effect of the tartrate of potash was again apparent. 10 drachms of tartrate of potash taken in three days produced but little, if any effect, on the acidity of the urine twenty-four hours after the last dose was taken.

"On the Direct Production of Heat by Magnetism," by W. R. Grove, Esq.—The author recites the experiments of Marrian, Beatson, Wertheim, and De la Rive on the phenomenon made known some years ago, that soft iron when magnetized emitted a sound or musical note. He also mentions an experiment of his own, where a tube was filled with the liquid in which magnetic oxide had been prepared, and surrounded by a coil; this showed to a spectator looking through it an increase of the transmitted light when the coil was electrized. All these experiments the author considers go to prove that whenever magnetization takes place a change is produced in the molecular condition of the substances magnetized; and it occurred to him that if this be the case a species of molecular friction heat might be produced. In proving the correctness of these conjectures difficulties presented themselves, the principal of which was that with electro-magnets the heat produced by the electrized coil surrounding them might be expected to mask any heat developed by the magnetism. This interference the author considers he eliminated by surrounding the poles of an electro-magnet with cisterns of water, and by this means, and by covering the keeper with flannel and other expedients, he was enabled to produce in a cylindrical soft-iron keeper when rapidly magnetized and demagnetized a rise of temperature several degrees beyond that which obtained in the electro-magnet, and which, therefore, could not have been due to conduction or radiation of heat from such magnet. By filling the cisterns with water colder than the electro-magnet, the latter could be cooled while the keeper was being heated by the magnetization. The author subsequently obtained distinct thermic effects in a bar of soft iron placed opposite to a rotating permanent steel magnet. To eliminate the effects of magneto-electrical currents, the author then made experiments with non-magnetic metals and with silico-borate of lead, substituted for the iron keepers, but no thermic effects were developed. He then tried the magnetic metals, nickel and cobalt, and obtained thermic effects with both, and in proportion to their magnetic intensity. Some questions of theory relating to the rationale of the action of what are termed "the imponderables," and to terrestrial magnetism, then were discussed; and the author concluded by stating that he considers his experiments prove that whenever a bar of iron or other magnetic metal is magnetized its temperature is raised.

June 14.—The Earl of Rosse in the chair. "On Carbonate of Lime as an Ingredient of Sea-water," by J. Davy.—Considering the matter in which cliffs consisting of limestone are worn away by sea-water in situations not favourable to the disengagement of carbonic acid gas, and, on the other hand, the manner in which sand is consolidated and converted into sandstone in other situations favourable to the disengagement of this acid gas, and the deposition of carbonate of lime (the cementing principle) in consequence, the author has been induced to make trials of the water of the ocean, in crossing the Atlantic, to endeavour to ascertain whether carbonate of lime is widely diffused through the ocean, or is an ingredient of sea-water at no great distance from land. The results of his experiments have been of a negative kind, seeming to show that carbonate of lime exists principally in seas, where its presence is most easily accounted for, and where in the economy of nature, it may be supposed, it is most useful. The author describes also some trials which he made on sea-water in relation to the sulphate of lime it contains, which he found to be variable in quantity in different situations. He suggests the propriety of having more extended inquiry made on this point, believing that the results may be important in connection with steam navigation,—the injurious incrustation which is liable to form in boilers at sea being composed chiefly of this compound.

GEOLOGICAL SOCIETY.

June 13.—Sir C. Lyell in the chair.—"On the Valley of the English Channel," by R. A. C. Austen, Esq.—The English Channel occupies a valley which may be described as one of depression between two parallel systems of elevation. This is shown by the dip of the secondary strata on either side being towards its centre. The epoch of this depression will depend on the age of the deposits included in it, which show that it has been under water at many distinct periods. When the submarine forests, seen on many parts of the coast, grew, it must, on the other hand, have been at a higher level; and hence Mr. Austen infers that it was dry land during the whole period of the coralline and red crag formations. These ancient forests not only pass below the present sea, but are covered by other formations, known as raised beaches. The materials spread over the bed of the channel seem chiefly derived from the coast line. For the first few fathoms depth the sea-bed is constantly changing; and the author has seen almost every portion of the south coast in the condition of sand, gravel, or bare rock at different times. In consequence of the prevailing direction of the winds the shingle moves constantly from west to east,—some pebbles found in the Chesil bank being derived from rocks not found nearer than Torbay. On the other hand, the raised beaches on the coast of Cornwall contain many chalk flints which can only have come from the east. These seem to have been carried westward during the pleistocene period, when the last depression of the Channel took place, connecting it with the Northern Ocean area,—when also blocks of northern rocks were carried south into it, like those found on the coast of Sussex. At that time, however, the Wealden was dry land; as the northern drift, which may be traced into the valley of the Thames, thins out and disappears before reaching it, as is well seen in the Reading and Reigate Railway cuttings. The west of England seems also to have been above sea at that period, though divided from the Weald by a strait. These tracts are distinguished by east and west axes of elevation; and the same system prevails in South Wales and in the south of Ireland—neither of which districts appear to have been submerged at that time. The depth to which the abrading action of the waves caused by winds extends is not more than forty to fifty feet. The tidal currents reach much deeper, as shown by the rippling of the surface over banks and shoals with a minimum depth of forty to forty-five fathoms, and over the Sole Bank at eighty fathoms, where the water is broken even in the calmest weather. To this motion the distribution of materials over the sea-bed is owing. These, as shown in a coloured map of the Channel, are carried outwards from the shore, and become finer as the distance and the depth increase. The bearing of this on geology is obvious—the sedimentary rocks now exposed being merely the aggregates of the soundings of ancient seas. The present deposits also increase horizontally, and not vertically; so that they do not fill up the sea or diminish the depth shown by soundings. In conclusion, Mr. Austen referred to the sudden increase in the depth of the sea, as shown by soundings beyond the line of 200 fathoms. On losing the bottom with a line of this length, 400 fathoms often fail to obtain soundings. This remarkable line of sudden depression he considers to have formed the coast line of an old continent belonging to the middle tertiary period, which attained its maximum elevation in the interval between the pliocene and pleistocene marine beds.

INSTITUTION OF CIVIL ENGINEERS.

June 19.—J. Field, Esq., president, in the chair.—"On the Employment of High-pressure Steam, working expansively, in Marine Engines," by Mr. J. Seaward.

This communication was described to be the substance of a reply, by the author, to questions asked by the Secretary of the Admiralty. It first reviewed the mode of working marine engines for some years past; and noticed the gradual change that had occurred, particularly the tendency to use high-pressure steam instead of that of a pressure of about four pounds above the atmosphere. It then examined the system of cutting off the steam at various parts of the stroke; and as at the same time a remarkable augmentation had occurred in the speed of the vessels, which was naturally attributed to that cause, it inquired into these several causes and effects, as well as into the reduction in the consumption of fuel which took place. In this examination, all the arguments for and against the use of high steam, and on the presumed gain or loss of mechanical power in the use of the expansion principle in the cylinder, were canvassed;

* Vide *Chemical Times*, vol. iv., page 318.

and the paper wound up with the replies of the author to the three questions from the Admiralty, to this effect:—"The highest pressure of steam that we have, in any case, put upon a marine boiler of our own construction was about 16 lb. to the square inch; but we are not inclined to repeat the experiment, as we feel assured that we can obtain equally good results with steam of a lower pressure. From 10 lb. to 12 lb. is the usual pressure we employ in the merchant service for engines and boilers of comparative small power. The steam pressure at present employed in the service is about 8 lb. per square inch. We consider steam of this pressure to be well adapted for the exigencies of the service; we believe it is calculated to secure all the important advantages of power, economy of weight and space, in a very eminent degree; these advantages will in some respects be slightly increased by augmenting the steam pressure to 10 lb. or 12 lb. to the square inch. We strongly recommend that the steam employed in the navy should not be of greater pressure than 10 lb. per square inch, or in extreme cases 12 lb. to the square inch; any material increase to the latter pressure will be attended with considerable risk, without any adequate advantage." In the discussion which ensued these propositions were to a certain extent concurred in, but with limitations as to the introduction of other forms of boilers; and it was explained that the arguments were applicable only to condensing engines working expansively,—and therefore left the question of the introduction of the use of high-pressure non-condensing engines quite untouched and free for discussion at a future period.

THE HEALTH OF LONDON.

[From the Report of the Registrar-General.]

The number of deaths registered in the week was 1,070; the weekly average for the summer quarter (which commences with the present month) of five previous years is 1,008; this return, therefore, shows an excess of 62. The whole mortality is also rather high, as compared with the numbers returned from week to week, during the last two months. There is an obvious increase in deaths caused by zymotic or epidemic diseases, with a decrease, though not to an equal extent, in those produced by affections of the respiratory organs. In the former class during the last three weeks the deaths have been progressively 277, 349, and 393; in the latter the numbers in the same weeks were respectively 119, 105, and 87. Hooping-cough numbers 47, or double the usual amount of fatal cases. Diarrhœa increases a little; but the deaths from it, which last week were 46, have not reached the average of the season, which is 76; for, in the previous years, chiefly in a more advanced part of the quarter, this complaint has carried off many children of tender age. In the corresponding week of 1846 the deaths from diarrhœa were 70. Two cases are reported of children who died—one of diarrhœa, another of hydrocephalus—at No. 3, Linney-court, Museum-street, where the back of the house has no windows, and the smell from drains and other nuisance in front is extremely offensive. The average at this season from cholera is only 8; its recent progress is shown by the deaths in the last six weeks, which were successively 9, 22, 42, 49, 124, and in last week 152, namely, 94 of males, and 58 of females. Of the 152 victims of this disease, 19 were under 5 years of age, 30 at 5 and under 15 years of age, 88 between 15 and 60 years, and 13 at 60 and upwards. The ages of two are not returned. It is worthy of observation that not more than 14 deaths from cholera last week occurred in the west and northern districts, though the population which they comprise is about a third of the whole. On the south side of the Thames there were 93, and in this region the districts of Rotherhithe, Lambeth, and Bermondsey are fatally distinguished. Other epidemics differ at present not much from the average. A young man died of "want" in Camden-town, and an infant of "exposure to the night air and purpura hæmorrhagica" in the Borough-road sub-district. A man of 48 died of "paralysis from working in a lead factory, after an illness of thirteen weeks." Mr. Butterfield, the registrar of Islington East, has recorded what he describes as "a curious fact," but without stating his authority, that women employed in this manufacture last much longer than men.

The mean height of the barometer in the week was 29.799. On Saturday, when the temperature was highest, the thermometer reached 82°.1 in the shade, and 103°.5 in the sun. The mean temperature, which for the week was 62°.7, was higher than the average on five days, and on Saturday exceeded the average by 9°.2.

The following fatal cases of cholera were registered in the week ending Saturday, July 7.

Nineteen are cases in which inquests were held; the remainder are all certified by medical attendants, except one:—

KENSINGTON; Fulham.—F. 5, "cholera (12 hours)."

ST. GEORGE, HANOVER-SQUARE; Mayfair.—F. 23, "cholera (13 hours)."

WESTMINSTER; St. John the Evangelist.—On 30th June, at 9, Little Tufton-street, an oilman's cellarman, 28, "cholera (12 hours)." On 2d July, at 6, Barton-street, a servant, M. 51, "Asiatic cholera (24 hours; collapse, about (15 hours); visited by medical attendant 12¼ hours before death;" F. 56, "spasmodic asthma (4 years); cholera biliosa (18 hours)." St. Margaret.—At Hyde-park barracks, a soldier, 29, "spasmodic cholera (8½ hours)."

ST. JAMES, WESTMINSTER; Golden-square.—At 10, Cross-street, Carnaby-street, F. 38, "Asiatic cholera, accelerated by bad drainage (14 hours)"—inquest. Mr. Churchman, the registrar, states that "deceased was in good health previous to the attack. A full cesspool, which communicates with the drain, became overcharged, and was opened for the purpose of being cleansed at the time deceased was attacked, which circumstance is supposed to have accelerated her death. Her husband, a porter, is now lying in the hospital, labouring under the same disease, and in a hopeless state."

MARYLEBONE; The Rectory.—F. 59, "cholera (4 days)." Christchurch. M. 28, "Asiatic cholera (10 hours)." St. John's.—On the 30th of June, at 11, Portland-terrace, St. John's Wood, M. 60, "cholera maligna (3 days)." Mr. Bachhoffner, the registrar, states that "the deceased, according to his medical attendant, caught the infection at his house on Ludgate-hill, in consequence of impure air which issued from a public privy at the back of the premises. It is stated that four persons have since died there from the same cause."

ST. PANCRAS; Camden-town.—In Fever Hospital, King's-cross, widow, a charwoman, 43, "cholera (27 hours)"—p.m. She was attacked with cholera in Cockpit-court, Fleet-street, and removed by the West London Union to the Fever Hospital, King's-cross, where she died in 10 hours after admission.

ISLINGTON; West.—At 17, Bath-place, Caledonian-road, a bookbinder, 20, "cholera (24 hours)." East.—At 5, Angler's-gardens, a printer, 45, "cholera (36 hours); delirium tremens (48 hours)." Mr. Butterfield, the registrar, states that "the neighbourhood where the above case occurred is very badly drained and densely inhabited."

HACKNEY; Hackney West.—M. 47, "cholera (16 hours)."

HOLBORN; St. Andrew, Eastern.—The following cases occurred in the Holborn Union:—F. 36, "Asiatic cholera (30 hours);" F. 6, "Asiatic cholera (45 hours);" F. 16, "Asiatic cholera (14 hours)." Saffron-hill.—"M. 17, "Asiatic cholera (24 hours); consecutive fever (3 days)." Deceased had just arrived from Sheffield, was very tall for his age, and of weakly constitution; the house at which he was staying was well-drained and ventilated, and very clean.

CLERKENWELL; Goswell-street.—M. 22, "cholera (14 hours)."

ST. LUKE; Whitecross-street.—M. 2, "cholera (32 hours)."

EAST LONDON; St. Botolph.—At 171, Bishopsgate-street-without, a mariner, 19, "cholera (5 days), typhus fever." Mr. Spencer, the registrar, states that "he had sailed from London to Newcastle, and other northern parts, and arrived at the platform, Rotherhithe, on June 30th, from Leith. He had been suffering from diarrhœa before he arrived at his mother's house, and was suddenly seized on the 1st instant with violent vomiting and cramps, which continued till his death. The house is large and well ventilated, and other inmates are in good health."

WEST LONDON; South.—At 15, Little New-street, M. 59, "cholera Asiatica (30 hours);" at 42, New Bridge-street, M. 60, "cholera;" at 164, Fleet-street, M. 39, "fever (10 days), cholera (2 days);" at 8, Parson's-court, F. 48, "cholera;" at 84, Farringdon-street, F. 53, "Asiatic cholera;" at 20, Plum-tree-court, F. 4, "Asiatic cholera (18 hours);" at Gough-square, F. 38, "consumption, cholera (4 days)." North.—The nine following cases occurred at St. Bartholomew's Hospital:—From 3, Ashton-court, Whitefriars, son of a printer, 11, "cholera (18½ hours);" from 20, Plum-tree-court, Shoe-lane, a carpenter, 62, "cholera (21 hours);" from Hangingsword-alley, Whitefriars, a commercial clerk, 68, "cholera (12 hours);" from same house, wife of the above, 62, "cholera;" from 48, Fleet-street, a fishmonger, 34, "cholera;" from 7, New-street, St. Andrew's-hill, Blackfriars, son of a porter, 12, "cholera;" fell down in Smithfield, and brought to the hospital; M. 20, "cholera;" from West London Union, West-street, wife of a labourer, "cholera (11 hours);" at 5, Newcastle-street, a printer, 35, "Asiatic cholera (4 days);" at 3, Fleet-lane, wife of a gentleman, 54, "Asiatic cholera;" at 32, Farringdon-street, wife of a coffeeshop-keeper, 53, "Asiatic cholera."

CITY OF LONDON; South-west.—At 1, Printing-house-lane, M. 10, "cholera (90 hours), diarrhœa (two days previous); at Union-street, M. 36, "Asiatic cholera (36 hours), consecutive fever and congestion of the brain (three days);" at 1, Pleydell-court, M. 45, "Asiatic cholera (12 hours);" at 3, Broadway, F. 38, "cholera;" at 3, Ireland-yard, F. 51, "cholera (16 hours)."

SHOREDITCH; Hoxton Old Town.—Wife of a compositor, 52, "natural death, sudden from Asiatic cholera (15 hours)"—inquest.

BETHNAL-GREEN; Hackney-road.—Wife of a cordwainer, 32, "cholera (12 hours)."

WHITECHAPEL; North.—At No. 10, Boar's-head-yard, Petticoat-lane, wife of a labourer, 42, "Asiatic cholera (16 hours)." Aldgate.—M. 5 weeks, "Asiatic cholera."

STEPNEY; Limehouse.—M. 6, "sudden from Asiatic cholera (11 hours)"—inquest; M. 35, "sudden from Asiatic cholera (4 days)"—inquest; F. 9, "sudden from Asiatic cholera (11 hours)"—inquest; F. 8, "cholera (6 days)." Ratcliff.—M., age not stated, "cholera (2 days);" F. 40, "Asiatic cholera (2 days)." Shadwell and Wapping.—M. 13, "cholera (12 hours);" M. 54, "Asiatic cholera (68 hours);" M. 43, "Asiatic cholera (16 hours)."

POPLAR; Bow and Bromley.—Straw-bonnet-maker, 31, "diarrhœa, spasmodic cholera (11 hours)." Mr. Dunstan, the registrar, states that "this case occurred in the Four-mill-street, Bromley, and is an exception to all other cases of cholera in this parish, inasmuch as most of the previous cases have occurred amongst the lowest class of society, residing in the filthiest and most crowded localities; but this took place in a respectable family, remarkable for temperance and cleanliness, residing in a well-cleansed and well-ventilated thoroughfare. Deceased was previously in perfect health."

ST. SAVIOUR; St. Saviour.—M. 3, "cholera (14 hours);" M. 53, "cholera (12 hours);" M. 9, "cholera (17 hours);" F. 38, "Asiatic cholera (21 hours); consecutive fever, aggravated by premature labour 84 hours after the

attack ;" F. 5, "Asiatic cholera (12½ hours)." Christchurch.—M. 62, "natural death, Asiatic cholera (13 hours), no specified cause ascertained, but the drainage of the parish bad generally"—inquest; M. 3, "natural death, Asiatic cholera"—inquest; M. 10, "cholera Asiatica (24 hours);" F. 36, natural; Asiatic cholera (64 hours)"—inquest.

St. Olave; St. Olave and St. Thomas.—On the 1st, on board the smack Gem, off Topping's Wharf, Southwark, son of the master mariner, 15, "cholera (14 hours), diarrhœa (7 hours), collapse (7 hours);" on the 5th, at 12, Magdalen-court, son of a labourer, 12, "catarrh (14 days), cholera (10 hours)." St. John.—M. 3, "Asiatic cholera (20 hours), exhaustion;" M. 26, "Asiatic cholera (12 hours) exhaustion;" F. 1, "had suffered from mesenteric disease, cholera (36 hours)."

Bermondsey; Leather-market.—M. 41, "Asiatic cholera (22 hours);" M. 47, "cholera (15 hours);" F. 52, "cholera (18 hours), had diarrhœa for some time." St. Mary.—At 2, Turner's-place, M. 36, "Asiatic cholera (17 hours);" at 105, Bermondsey-street, M. 52, "cholera Asiatica" (36 hours);" at 1, Russell-street, M. 30, "Asiatic cholera." St. James.—F. 6, "Asiatic cholera (7 hours);" F. 31, "Asiatic cholera (75 hours)." These were the deaths of mother and daughter. The medical attendant states that their residence is surrounded by ditches from which the inhabitants obtain water for use. M. 43, "Asiatic cholera (24 hours);" M. 65, "Asiatic cholera (16 hours);" F. 13, "Asiatic cholera (25 hours)." These three cases occurred in houses near the tidal ditch previously reported, which becomes more offensive daily. The poor people on its banks are in a state of fear and excitement, which has a tendency to aid the development of the disease. M. 47, "Asiatic cholera (9 hours;" F. 61, "Asiatic cholera (8 hours); no medical attendant." Mr. C. Martin, the registrar, states that "according to the medical attendant a filthy open sewer runs within six feet of the back of deceased's residence, into which four privies are emptied, but which is flushed, as he was told by the friends, twice a week."

St. George, Southwark; Kent-road.—M. 52, "Asiatic cholera (14½ hours);" M. 9, "Asiatic cholera (12 hours)." Borough-road.—M. 48, "cholera maligna (24 hours)."

Newington; St. Mary.—M. 11 weeks, "cholera (24 hours);" M. 2, "English cholera (24 hours);" F. 18, "cholera (36 hours)." Walworth.—F. 35, "Asiatic cholera (29 hours)." Trinity.—At 5, Horsemonger-lane, daughter of a carpenter, 18, "cholera (24 hours)."

Lambeth; Waterloo (first part).—In Waterloo-road, son of a cabinet-maker, 15, "Asiatic cholera (9 hours)." The house in which the above case occurred is well ventilated, and there is no defect in the drainage, and deceased was in previous good health. The three following cases occurred in Mitre-place, Broadwall, near the ditch which divides the two parishes. The children had partaken of tainted meat, and their food was generally of the most indifferent nature:—Son of a labourer, 7, "Asiatic cholera (20 hours);" son of a labourer (age not stated), "Asiatic cholera (4 days);" daughter of a labourer, 10, "Asiatic cholera (28 hours)." At Sidwell-place, Broadwall (the next court to Mitre-place), wife of a labourer, 29, "Asiatic cholera (24 hours)." Although the houses are new, they are subject to similar influences of locality, and are densely crowded. A child has been removed to the workhouse, which has since died. Waterloo (second part).—At 70, St. James-street, F. 43, "cholera (6 days)." Mr. Daws, the registrar, states that "there are water-closets in the vicinity where the above case occurred which are very offensive. A ditch was filled up some time back, and notices have lately been served respecting the other nuisance."

Lambeth; Lambeth Church (first part).—M. 43, "malignant cholera (9 hours);" M. 8, "cholera Asiatica (32 hours);" M. 21, "Asiatic cholera (42 hours);" M. 15, "diarrhœa (3 days), cholera spasmodica (13 hours);" F. 49, "cholera (24 hours);" F. 6, "cholera Asiatica (10 hours);" F. 82, "cholera Asiatica (14 hours), consecutive fever (5 days)." Lambeth Church (second part).—M. 70, "cholera Asiatica (3 days);" F. 3, "natural death, Asiatic cholera (7 hours)"—inquest. Kennington (first part).—At 14, Southampton-street, Nine-elms, a carpenter, 66, "malignant cholera (7 hours);" at Wild's-buildings, White Hart-street, Kennington, son of a walking-stick-manufacturer, 14, "malignant cholera (12 hours)." Kennington (second part).—At 2, Bolton-street (close to a very bad ditch), M. 11, employed at a surgeon's, "cholera (20 hours)."

Camberwell, Peckham.—At 13, Canterbury-row, Old Kent-road, gardener, 58, "Asiatic cholera (58 hours);" at workhouse, High-street, daughter of an inspector of police, 3, "cholera (9 hours)."

Rotherhithe; Rotherhithe.—M. 65, "Asiatic cholera (10 hours);" M. 60, "Asiatic cholera (11 hours);" M. 37, "Asiatic cholera (12 hours);" M. 34, "cholera (38 hours);" M. 4, "cholera (15 hours);" M. 11, "cholera (15 hours);" M. 8, "Asiatic cholera (9 hours), collapse;" seaman of the brig Caroline, of Sunderland, in the river Thames, at Rotherhithe, 52, "English cholera (37 hours)"—inquest; seaman of the brig Midas, of London, in the river Thames, off Rotherhithe, 24, "Asiatic cholera (14½ hours)"—inquest; M. 3, "cholera (14 hours);" M. 37, "cholera (24 hours);" M. 4, "Asiatic cholera (19 hours);" M. 4, "cholera (11 hours);" F. 2, "cholera (20 hours);" F. 7, "cholera (9 hours);" F. 13, "cholera (10 hours);" F. 52, "cholera (3 days);" F. 10, "cholera (48 hours);" F. 50, "acute rheumatism (3 weeks), cholera (5 hours);" F. 2, "Asiatic cholera (30 hours);" F. 16, "cholera (39 hours);" F. 42, "phthisis, cholera (32 hours);" F. 11, "Asiatic cholera (36 hours);" in Rotherhithe Workhouse, waterman, 22, "natural death, Asiatic cholera (3 days)"—inquest.

Greenwich; St. Paul's, Deptford.—F. 14, "enteritis, with cholera symptoms towards the termination (4 days)." Woolwich Arsenal.—In Unité hospital-ship, a convict, 45, "Asiatic cholera (14 hours)"—inquest; in same hospital-ship, a convict, 25, "Asiatic cholera (2 days)"—inquest. Greenwich, East.—M. 21, "Asiatic cholera (9 hours)"—inquest; F. 2, "Asiatic cholera (40 hours)"—inquest. Greenwich, West.—The five following cases occurred on board the Dreadnought hospital-ship:—M. 29, "cholera"—p.m.; M. 22, "premonitory diarrhœa (2 days), cholera (3 days);" M. 28, "premonitory diarrhœa (3 days), cholera (5 days);" M. 51, "premonitory diarrhœa (3 days), cholera (24 hours);" M. 20, "cholera (3 days)."

Wandsworth and Clapham, Battersea.—At Green-lane, a shoemaker, 28, "malignant cholera (27 hours)."

Lewisham; Lewisham village.—M. 42, "English cholera"—inquest; M. 2, "cholera (12 hours)"—inquest; M. 15, "cholera (10 hours)"—inquest.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Andrew Lamb, of Southampton, engineer, and William Allhoft Summers, of Millbrook, in the county of Southampton, engineer, for certain improvements in steam-engines and steam-boilers, and in apparatus connected therewith. Patent dated December 9th, 1848. Enrolled June 9th, 1849.

These improvements in steam-engines consist—First, in the method of working the air-pump, or pumps of that class of marine steam-engines known as double side-rod engines, and which is effected by means of eccentrics placed on the intermediate shaft, instead of the crank usually employed. In one instance given the eccentric rods work a small beam or lever, to the ends of which the air-pump rods are connected. This beam is placed between the steam cylinder in a position transverse to the main shaft, and worked by one eccentric. In another case the pumps are worked directly from the eccentrics, the pumps being placed at a suitable inclination for that purpose; here, also, they are shown as worked from one eccentric, by simply attaching two rods to the same eccentric strap. The patentees do not confine themselves to working the pumps of double side-rod engines by these means, as other direct-acting engines may be similarly fitted.

In double side-rod engines, in which the parallelism of the side-rods is maintained by guides on the sides of the cylinder, the patentees construct the cross head in the form of a cross, and working the pumps from the two additional arms, in which case the pump-buckets would necessarily move the whole distance of the stroke; the cross head in the direction of the pumps is guided by V guides, placed between the pumps and the entablature. In this manner, also, one pump may be worked with one additional arm to the cross head, the pump-rod being furnished with a cross head, connected by two diagonal rods to pins projecting beyond the side-rods, being either a continuation of the pin, to the lower end of which connecting rods are attached, or else pins placed or fixed to the cross-tail pieces of those rods. The patentees observe that, in working one pump in this way, the bearing surface of the side-rod guides should be considerably increased, to prevent abrasion of the surface. This method of working one pump on each side of the steam-cylinder is shown as adapted to the engines known as the Gorgon engines, which are on the direct-acting principle, with a short connecting rod, the mode of working being very similar to that already described.

The second part of this invention has reference to the construction of steam-boilers, and is principally applicable to marine steam-boilers. The improvement consists in the substitution of flat-sided tubes for the ordinary cylindrical tubes, used as the return flues in such boilers. These flat-sided tubes—or, as they may be more properly termed, flues—are placed on their edge, and extend the whole depth of the return flue space, and are disposed at such a width from each other as to admit of a descending as well as an ascending current of water between them. These flat-sided flues are constructed of flat plates, having curves at the edges where they are connected together; the plane of the sides is maintained by rivets or bolts, with a ferrule between the plates, the width of the flues being such that, with the spaces between each, eleven or twelve occupy the ordinary width of a fire. Although these flat-sided flues are mentioned as being used as the return flues, they may, of course, be differently disposed, and used as direct flues from the furnace.

As a further improvement in marine boilers, the patentees construct the flue doors of double plates, and supply the space with a current of cold water, caught from the spray of the paddles, and conducted thereto by pipes; when, having become heated, it is run off from the upper part of the space to the bilge, or thrown out by other means. This supply of cold water is (as the patentees observe) ostensibly for the purpose of lowering the temperature of the engine-room.

The third part has reference to the mode of arranging and constructing the pumps usually employed in feeding marine steam-boilers; it consists simply in enclosing the pumps, together with their working gear, in a chamber, into which the pumps throw the water; the upper part forming an air space for equalizing the pressure. The drawing shaft passes through the upper part of the chamber, its bearings being furnished with stuffing-boxes to render it air-tight. On this shaft are placed two or more eccentrics, according to the number of pumps, the buckets of which are worked direct from the eccentrics.

The patentees claim as of their invention :—

First. The employment of eccentrics, affixed to, or connected with, the shaft of the engine, for working the air pump or pumps.

Secondly. The employment in all such steam-engines as have but one piston-rod to each cylinder, and the crank connecting-rod placed below the crank shaft, of the mode of working the air-pump, by attaching their connecting rods directly to the cylinder cross head, as described.

Thirdly. The employment in double side-rod engines, of that description in which the said rods are guided by slides affixed to the sides of the cylinders, of the mode of working the air-pumps by means of motion derived from studs or pins, fixed either to the lower ends of the said rods, or to the cross tailside rods.

Fourthly. The combined employment in steam-engines of flues having flat sides with internal stays, and water spaces between them of sufficient width to allow of air ascending, and also a descending current in each water space; and also smoke-box doors, admitting of direct access to the flues.

Fifthly. The construction of smoke-box doors, with water spaces formed in them, for lowering the temperature of the adjoining engine-room, no matter how these spaces may be supplied with water, or how the water, as it becomes heated, may be discharged therefrom.

Sixthly. The working of auxiliary pumps, used in steam-vessels for the purpose of filling or feeding the boiler, by means of eccentrics; and the placing of the pumps and eccentrics and part of the eccentric shaft within a box or casing, which serves at the same time as the air-vessel for the pumps, as described.

Israel Kinsman, late of New York, but now of Ludgate-hill, merchant, for improvements in the construction of rotary engines, to be worked by steam, air, or other elastic fluid. Patent dated December 28th, 1848. Enrolled June 28th, 1849.

This specification relates to the construction of rotary steam-engines, and describes certain improvements in a rotary engine, the subject of a former patent granted to the present patentee, the specification of which is dated May 11th, 1848.

The principle upon which the engine of the patentee works is that of a piston-wheel fixed upon a shaft or axis, and revolving within a stationary cylinder or case; and the employment of a number of steam stops or abutments, which project into the stationary cylinder, and move outwards at the proper time, so as to permit the pistons upon the piston-wheel to pass by them; the packed edges of the steam-stops moving in contact with the periphery of the piston-wheel, so as not to permit any steam to pass; the steam-stops not being actuated by the periphery of the piston, but by means of cranks, which derive their motion from the shaft of the piston-wheel, and are therefore governed by the movement of the piston-wheel.

The specification is accompanied by illustrative engravings.

The piston-wheel is fixed upon a shaft revolving in bearings at each end, outside of the cylinder, upon the framing of the engine. The cylinder is fixed to the framing, and is, consequently, stationary; the number of pistons upon the piston-wheel must always be one more in number than the number of steam stops or abutments; which, in the drawings annexed to the specification, are represented to be five of the former, and four of the latter. The pistons are packed so as to preserve the points of contact between them and the interior surface of the cylinder steam-tight. The steam-stops project into the cylinder, and their edges come in contact with the periphery of the piston-wheel; they are provided with packing at the part in contact with the piston-wheel, and which can be tightened up when required. The steam-stops pass through stuffing-boxes upon the cylinder. The ends of the piston-wheel are maintained steam-tight by means of packing-rings, one at each end of it; the face of the rings being pressed in contact with the ends of the piston-wheel, and they are tightened up and adjusted by means of set-screws, which act upon wedge-shaped sectional rings, placed at the backs of the packing-rings, which latter are made with a corresponding bevil to effect the object. Thus, by screwing up the sectional rings, the packing-rings are pressed against the ends of the piston-wheel. The faces of the packing-rings are likewise provided with groves or recesses, into which pass the ends of the steam-stops, and, as the movement of them in and out of the cylinder takes place, they slide within these grooves in the packing-rings. Those parts of the steam-stops within the grooves, and which are also beyond the ends of the piston-wheel, are somewhat deeper than the parts in contact with the periphery of the piston-wheel, and thus they embrace the ends of the piston-wheel in a steam-tight manner. Upon the shaft is fixed a spur-wheel, which, of course, revolves with the piston-wheel, and thus gives motion to spur-pinions attached to the ends of the cylinder; upon the axes of these pinions are placed cranks, or, in lieu thereof, pins upon one of the arms of the pinion. From these, connecting-rods communicate to the cross heads of the steam-stops. Thus it will be seen that the revolutions of the piston-wheel give the required movement—through the spur-wheel, pinions, and cranks—to the steam-stops, which movement is identical to the curve of the periphery of the piston-wheel, so that the steam-stops and the periphery are always in contact.

The ends of the cylinder are provided with annular passages or chambers, one of which is for the ingress and the other for the egress of steam from the cylinder. From these chambers or passages, ingress and egress ports pass to and from the cylinder, one on each side of the steam-stops; these ports pass through the packing-rings, and are closed by means of cut-off balance-valves, for the purpose of regulating the supply of steam to the cylinder; they are worked by means of eccentrics, or cranks, upon the axis of the spur-pinion. The supply-valve is so constructed that by reversing the position of the valve the steam is admitted to the opposite end of the cylinder, thus reversing the movement of the engine.

The patentee claims :—

First. The mode described of operating the steam stops or abutments, by means of a crank motion, which is derived from the rotation of the piston-wheel; and when acting in combination with the rotating piston-wheel, the form or contour of the periphery of which piston-wheel is such as is generated by its rotation, and by the movement of the steam-stop; and so that the edge of the steam-stop may always be in contact with the periphery of the piston-wheel, and at the same time is not worked by it.

Secondly. The constructing the steam-stops with projecting ends, so that they embrace the sides of the piston-wheel, and pass or extend within its periphery—in combination with the grooves or recesses in the packing-ring—whereby the steam is prevented from passing from one side of the piston to the other.

Thirdly. The employment of cut-off valves, acting in combination with the rotating piston-wheel, and operated upon by eccentrics on the cranks which operate the steam-stops, so that the cutting-off of the steam may be governed by the motion of the steam-stops.

Fourthly. The construction and employment of the continuous annular chamber at the side of the cylinder, and communicating with the steam-pipe and the steam-ports, when in combination with cut-off valves.

Fifthly. The mode described of packing severally the piston-wheel, the steam and exhaust ports, and the ends of the steam-stops, by providing the packing-ring with holes, corresponding to the ports, and the grooves or recesses for the reception of the ends of the steam-stops.

Sixthly. The method of packing the steam-wheel at each end, by means of the packing-rings in connection with the wedge-formed sectional rings adjusted by set-screws.

John Penn, of Greenwich, in the county of Kent, engineer, for certain improvements in marine steam-engines. Patent dated December 21st, 1848. Enrolled June 21st, 1849.

The improvements comprised in the first and second heads of this specification will be found, by reference to the claims, so simple as not to require further exposition.

The third improvement in marine steam-engines has reference to that class of vessel in which steam power is used as an auxiliary only; the improvement consisting in the application of an intended self-acting apparatus, and adapted to cause the propelling power of the engine to be exerted in an inverse ratio to the speed the vessel makes through the water; the apparatus being such that the steam (in working expansively) is admitted to the cylinder throughout a greater portion of the stroke at a time when the speed attained by the power of the wind is slow; while any increase of power derived from the wind is attended with a corresponding diminution of the steam power, by cutting off the steam at an earlier period of the stroke.

The moving power of this apparatus consists of a small paddle, placed with its axis vertically in a position so that one of the blades or boards will project through the ship's side, in such a situation as to be propelled by the passage of the ship through the water, from which it receives a corresponding velocity. Instead of a paddle or float wheel, a propeller, similar to the ordinary screw-propeller, may be employed; being similarly situated to receive the impulsive force of the water. This propelling apparatus is enclosed within a box or case, with a tube rising above the water level, and up which the axis of the paddle is carried, giving motion by bevil gear to a horizontal crank shaft; the crank being employed to give motion to a pair of bellows similar to the ordinary circular bellows used by smiths. The lower board of these bellows receives the motion of the crank, so as to force air into the upper chamber, from which it is suffered to escape through a stopcock. The weighting of the upper board is so arranged as to increase as the board attains a higher level, and, consequently, to confine the air in the upper chamber under a greater pressure. The stopcock is opened according to the capacity of the bellows, and the time necessary to be occupied for the escape of the air so condensed. The action of the apparatus is as follows :—On the vessel becoming slow in her progress through the water the bellows board will be driven slowly, and, consequently, little air will be forced into the upper chamber; this would only raise the upper board slightly, or until the escape of the air at the stopcock, and the air forced in by the action of the bellows, are in equilibrium, when the upper board will remain stationary. On any increase of speed through the water taking place a corresponding increase of motion will be imparted to the bellows. This will have the effect of forcing a greater amount of air into the upper chamber than will escape at the stopcock at the elevation and pressure attained; consequently, the upper board will be forced to a higher level. On the upper board rising the weight continually increases, until a point is reached, when the air escaping (by reason of the increased pressure), and the air forced into the upper chamber, are again in equilibrium; when the upper board will again remain stationary, so long as that speed may be maintained; any variation of speed, it will be observed, producing a variation in the height of the bellows board.

In stationary engines, working expansively, the action of the governor upon the expansion-valves is well understood, the governor being so connected with the working gear of the expansion-valves as to increase or decrease the duration of the admission of steam to the cylinder; that is, to cut it off at a later or earlier

period of the stroke. This, it is well understood, is effected by causing the cam roller to traverse in the direction lengthways of the shaft on which the expansion cams are placed; the increased cam surface being produced by an inclined, instead of the gradatory, surface employed when not intended for self-action. The action of the bellows board is caused to effect a like change in the position of the cam roller with respect to the inclined cams. In this case the bellows board, when forced to a high level, is so connected to the cam roller as to carry it to a point where the expansive-valves will be opened to the least extent; any corresponding fall producing a corresponding change in the action of the cams upon the expansive-valves. By this arrangement a uniform speed will be maintained with the least possible expenditure of steam; this being ensured by the self-action of this apparatus, which varies the power of the engine in exact proportion to the ever-varying power of the wind. The bellows board is also shown as connected with the throttle-valves, but which may be dispensed with. In order to render the action of the whole as complete as possible the bellows board is also caused to actuate a damper in the chimney, so as to damp the fires in due proportion.

The patentee claims as his invention:—

First. The application of a floater, within a condenser (or in a vessel in connection therewith), of a marine steam-engine, or pair of engines; and also applying a stopcock or valve to the passage through which the injection-water enters, so that it shall be capable of stopping the flow of the injection-water into the condenser.

Secondly. The improvement described of applying a suspended balanced vessel or vessels, within the passage or passages leading from the boiler or boilers, to the cylinder or cylinders of a marine steam-engine, or pair of such engines, or any other number of such engines. And also applying a stop-valve in the steam passage or passages; which said valve and suspended balance vessel are so connected that the suspended balance vessel, on receiving any water that may boil over from the boiler or boilers, and pass along the said steam pipe or pipes with the steam (in the manner commonly called priming), shall become so much heavier as to gravitate or descend, and thereby to close, or nearly close, the said valve, and interrupt the free passage of the steam from the boiler to the cylinder, &c. &c.; such interruption diminishing the influx of steam so much as to propel the engine or engines at only a slow speed, and such as will not be calculated to subject the engine to any strain likely to break or derange any of the parts, should any water get into the cylinder in consequence of such priming or boiling over.

Thirdly. The improvement of applying a mechanical contrivance to marine steam-engines, such as are used as an auxiliary propelling power to sailing-vessels, by which the power is applied inversely to the speed of the vessel by increasing or diminishing the influx of steam from the boiler to the cylinder, by the self-action of the said apparatus—that is to say, when the vessel is making the slowest progress through the water the influx of steam to the cylinder is greatest, and *vice versâ*, by the action of the said apparatus on the expansion-valves. This apparatus may also be caused to operate upon a damper, so as to regulate the draught of the fire to suit the expenditure of steam.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING JULY 4TH, 1849.

Thomas Greenwood, of Goodman's-fields, in the city of London, sugar-refiner, and Frederick Parker, of New Gravel-lane, Shadwell, animal charcoal manufacturer, for improvements in filtering syrups and other liquors. Patent dated July 4th, 1849; six months.

John Robinson, of Patterson-street, Stepney, in the county of Middlesex, engineer, for improvements in machinery for moving and raising weights. Patent dated July 4th, 1849; six months.

John Grantham, of Liverpool, engineer, for improvements in sheathing ships and vessels. Patent dated July 4th, 1849; six months.

Josiah Bowden, of Liskeard, linendraper, and William Longmaid, of Beaumont-square, in the county of Middlesex, gentleman, for improvements in the manufacture of soap. Patent dated July 4th, 1849; six months.

Sir Francis Charles Knowles, of Lovell, in the county of Berks, Bart., for improvements in the manufacture of iron and steel. Patent dated July 4th, 1849; six months.

Richard Archibald Brooman, of London, Middlesex, for improvements in steam-generators. Patent dated July 4th, 1849; six months. (Communication.)

James Mulbery, of Parkersburgh, in Chester, county of Pennsylvania, in the United States of America, machinist, for certain improvements in the slide-valves of steam-engines. Patent dated July 4th, 1849; six months.

William Henry Wilding, of the New-road, in the county of Middlesex, gentleman, for certain improvements in engines, and in obtaining and applying motive power. Patent dated July 4th, 1849; six months.

Robert William Thomson, of Leicester-square, in the county of Middlesex, civil engineer, for certain improvements in writing and drawing instruments. Patent dated July 4th, 1849; six months.

William Bush, of Great Tower-street, in the city of London, civil engineer, for improvements in lamps and in lighting. Patent dated July 4th, 1849; six months. (Communication.)

John Combe, of Leeds, in the county of York, civil engineer, for improvements in machinery for heckling, carding, winding, dressing, and weaving, flax, cotton, silk, and other fibrous substances. Patent dated July 4th, 1849; six months.

William Henry Brown, of Ward's End Wheel, at Wadsley, in the parish of Ecclesfield, in the county of York, steel-roller, for improvements in rolls, for rolling flat and half round file and other iron and steel. Patent dated July 4th, 1849; six months.

Pierre Augustin Chauffourier, of Regent-quadrant, in the county of Middlesex, merchant, for improvements in castors. Patent dated July 4th, 1849; six months. (Communication.)

John Browne, of Great Portland-street, Portland-place, in the county of Middlesex, Esq., for improvements in apparatus to assist combustion in stoves or grates. Patent dated July 4th, 1849; six months.

Henry Bailey, of Wolverhampton, in the county of Stafford, chemist, for certain improvements in the construction of articles of wearing apparel; which improvement are also applicable to fastenings for the same. Patent dated July 4th, 1849; six months.

Robert Weare, of Birkenhead, in the county of Chester, clock and watch maker, and William Peter Piggott, of Wardrobe-place, Doctors' Commons, in the county of Middlesex, mathematical instrument maker, for certain improvements in electric batteries; and in the production of light; also a mode of transmitting or communicating intelligence for the better protection of life or property, parts of which improvements are applicable to like purposes. Patent dated July 4th, 1849; six months.

PATENTS RECENTLY EXPIRED.

T. Walker, Burslem, mechanic, for improvements in extinguishers to candles, and in the application of such extinguishers to candles and candlesticks. Patent dated July 3d, 1835. Expired July 3d, 1849.

J. Kean, Renfrew, machine-maker, for an improved throstle-flyer; a substitute for an ordinary flyer employed in spinning cotton, flax, hemp, wool, silk, and other fibrous substances. Patent dated July 3d, 1835. Expired July 3d, 1849.

THE SALE AND ADULTERATION OF BREAD.—A bill introduced into the House of Commons by Mr. Bankes, Mr. R. Spooner, and Mr. Stuart, proposes to "prevent frauds in the sale of bread, and to make further provision for securing the wholesome quality of articles used in the manufacture of bread." With this object in view, it enacts that after the 1st of October next all bakers and dealers in bread shall impress on the outside of all bread made and exposed by them for sale (excepting rolls of fancy bread), in large and distinct figures, the imperial weight of such bread, under a penalty of 40s. for every violation of this law. Bakers offering bread for sale under the weight so impressed will be punishable by a fine of £5 for every offence. The inspectors of weights, constables, and other persons, may be empowered by magistrates to examine shops and other places where bread is sold. Clause 3 provides for the further prevention of the adulteration of meal and flour. The act is not to extend to Ireland.

The size of some of the stones quarried at the Dartmoor Granite-works may be imagined from one which was blown out a few days ago by Messrs. Filmer and Hoar. The length of the block was 30 feet; breadth, 23 feet; height, 24 feet; cubical contents, 16,560 feet; and it weighed no less than 1,380 tons. Only 50lbs. of powder were used in blasting.

TO CORRESPONDENTS.

"A Reader's" suggestion is under consideration.

"Beta."—Next week.

"A Subscriber from the Commencement."—Try the following process:—Take white sugar, 20 pounds; lemon or lime juice, 18 fluid ounces; honey, 1 pound; bruised ginger, 22 ounces; water, 18 gallons. Boil the ginger in 3 gallons of the water for half an hour; then add the sugar, the juice, and the honey; together with the remaining 15 gallons of the water. Strain the whole through a cloth. When cold, add the white of one egg, and half a fluid ounce of essence of lemon. Let the mixture stand for four days. Bottle. This yields a very superior beverage, and one which will keep for many months.

"Mr. Marsham, Kensington."—The ingredients of Loysel's artificial diamonds are:—Pure silex, 100 parts; minium, 150 parts; calcined potass, 30 to 35 parts; calcined borax, 10 parts; oxide of arsenic, 1 part. This produces a paste which has great brilliancy and refractive and dispersive powers, and also a similar specific gravity to the oriental diamond. It fuses at a moderate heat, and acquires the greatest brilliancy when remelted, and kept for two or three days in a fused state, in order to expel the superabundant alkali and perfect the refining.

"A Druggist."—Liable to the stamp duty.

"H. B.—Taylor and Walton's, Gower-street."—£1 11s. 6d.

"Mr. Richard Lee, Glasgow."—Shaving paste is prepared as follows:—Take white wax, spermaceti, and almond oil, of each ½ ounce; melt, and, while warm, beat in 2 squares of Windsor soap previously reduced to a paste with rose-water.

"X. Y. Z."—We must decline for the present.

"Mr. Manty, Liverpool."—We will endeavour to comply with your request by the end of next week. Four of the numbers have been already forwarded, together with Vols. I. and II. of the *Pharmaceutical Times*.

THE CHEMICAL TIMES is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentleman may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary or scientific communications to be addressed to the Editor, 320, Strand.

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ORIGINAL SERIES.

ELECTRIC CONDITION APPLIED TO GEOLOGY AND TO AGRICULTURE.

By FRANKLIN COXWORTHY, Esq.,
Author of "Electrical Condition."

Since the days of Priestly, when science began to dawn, it has been the anxious desire of the philosopher to reduce all the sciences to one general principle. But unfortunately, misguided by outward appearances, his labours to attain this important end have been in vain. The assumed identity of heat with electricity, which so long has bewildered his understanding, instead of facilitating a clear comprehension of the simple laws of the Creator, has led him only deeper into the labyrinth of mystification.

The *Lancet*, in its columns of the 23d of September, 1848, notices a paper read by M. Fourcault, at the Academies of Medicine and of the Sciences at Paris, on the theory of cholera, in which that gentlemen refers the cause of that disease to non-equilibrium of atmospheric electricity and terrestrial magnetism, and also advances an opinion that "no satisfactory results can be arrived at until general physics, descriptive geology, hydrography, and meteorology be more closely linked to medicine,"—a doctrine that would have been altogether novel, had I not previously shown in my papers of 1847, and in "Electrical Condition," how these and other subjects are identified with the health of both the animal and vegetable kingdoms.

The editor of the *Lancet*, in his review of "Electrical Condition," in the number of June, 1848, observes:—

"Mr. Coxworthy 'endeavours to show that cold is the positive condition of electricity, and that heat is the negative state;' and at page 6 he arrives at the conclusion that 'cold is material.' He may be satisfied of this in his own mind, but he does not give proper evidence of the fact, perhaps from want of space. His remarks on the formation of snow are worthy of attention.

"At page 6 we have the following ingenious experiment:—

"'We made a boiling solution of alum, and put it into an oven of about the temperature of 200° to cool or settle; and put into the oven, with the jug containing the solution, two tumblers in every respect of the same construction, that they might be raised to the temperature of the solution. These preliminary arrangements having been made, an equal amount of the solution was poured into each tumbler, previously insulated, and suspended over the oven in a temperature of 80°. At the other end of the room was placed a freezing mixture of ice and salt, also insulated, having in the centre of it a copper coil, which copper coil was connected with one of the tumblers by a fine copper wire, the length of the wire, which was broken into joints, connecting the freezing mixture and solution, being ten feet.

"'About ten minutes after the connection was established a stream of beautiful crystals fell from the top of the solution to the bottom of the glass, although no action whatever was apparent in the other solution. After the operation had gone on some time, and the solution in the other glass began to crystallize at the bottom of the glass, two other tumblers were placed upon the table, and the menstruum of the two insulated tumblers was thrown into them: that of the connected solution immediately crystallized all over the interior of the glass, in an aborescent form; whilst the other crystallized slowly at the bottom of the glass, affording evidence, not only of the influence exercised by the freezing mixture while connected, but also of its having imparted to the solution itself altogether a different character to that which it originally possessed.'"

Now, what I maintain is, that "cold is material, and, therefore, something more than the mere absence of heat." By this I mean to imply that cold is the positive electrical state, heat the negative; and if electricity be material cold must be material, the "ingenious experiment" referred to by the *Lancet* being one of the strong proofs which I adduce in support of my conclusion, as the following extract from my pamphlet on "Electrical Condition" clearly shows:—

"Electricity has long been known to be an active agent in crystallization; cold exercises a similar, although less active, influence; and the above-described experiment affords evidence that, during the production of an intense cold, an agent is set free that gives to a crystallizing salt all the properties imparted to it by an electric current; and on reference to the tables of freezing mixtures it will be observed that the more dense or highly crystallized the salt the greater is the intensity of the cold produced."

I have thought it desirable thus particularly to refer to the above as one of the main points of all my reasoning; and, in entering upon the arduous task of applying to geology this and the other conclusions I have arrived at—perhaps in error—I shall do so, not for the purpose of giving my views on geology, but simply with the intention of putting my principles to the test of the valuable results which the labours of the geologist have elicited.

In December, 1846, I submitted the following remarks to Professor Faraday:—

"There is a question connected with the decomposition of matter, whether by decay, putrefaction, combustion, or respiration, that appears to me never to have received that consideration which its importance to chemical, agricultural, and metcorological science unquestionably renders it deserving of.

"The operation to which I allude is the restoration to the earth and to the atmosphere of the vast quantity of carburetted hydrogen that is given off during the decomposition of vegetable matter, and of the immense amount of nitrogen liberated during combustion and respiration.

"A slight idea of the amount of carburetted hydrogen liberated is given at pages 12 and 13 of my pamphlet, and when it is borne in mind that for every pound of carbon converted into carbonic acid (to say nothing of the hydrogen converted into vapour) about 150 feet of nitrogen must be set free, the amount of this gas that is constantly being disengaged from the atmosphere, both by combustion and respiration, must be enormous.

"Diffusion does not imply chemical action; and, as these gases, the carburetted hydrogen and the nitrogen, have no affinity for moisture, it is quite clear that the vegetable kingdom can exercise no influence on them; and it is equally evident that, were they not subservient to the law of gravitation, the atmosphere would soon be considerably contaminated.

"I suspect that water during evaporation from natural causes undergoes decomposition,* and in support of that opinion it may be observed that it is decomposed by the galvanic battery, and the utmost man can accomplish being to bring into operation principles that are already in existence in nature there must be a decomposing influence in the atmosphere, otherwise the poles of a battery could not possess that property.

"On the 10th of October, 1845, I suspended under a lean-to roof two copper scales seven inches in diameter, one by silken threads, and the other by fine copper wire, and put thirty-two ounces of water into each. I find, as a general result, that, during bad weather, or before rain, the non-insulated scale evaporates quicker than does the insulated one, and the reverse during fine weather; that the rate of evaporation is influenced to an amazing extent by what is termed heat; and that the insulated scale evaporates much more than does the non-insulated one.

"From the 18th to the end of January, when the barometer stood on an average at 29.50, and the thermometer at 47°, and we had rain and mist nearly every day, the non-insulated scale evaporated twenty grains daily more than did the insulated one; whilst from the 7th to the 12th of March, when the barometer stood on an average at 30.25, the thermometer at 45°, and we had remarkably fine weather, the insulated scale evaporated twenty-five grains daily more than did the non-insulated one; and on the 4th and 5th of May, the thermometer having stood at 60° on the 3d, and the barometer was falling, the non-insulated scale evaporated so much as forty-five and fifty-five grains more than did the other, Now, if evaporation be referable to 'heat,' how is it that the water in the vessel that is under the influence of the colder medium evaporates quicker than does that in the other, if the rise of temperature in the air be accompanied by a falling mercury?

"Experiments which, through the kindness of the directors of the Polytechnic Institution, I performed with their hydro-electric machine fully satisfied me that high-pressure steam, which is cold, is positively electric, whilst low-pressure steam, which is hot, is negatively electric; and if a Florence flask be nearly filled with water, and the water be raised to violent ebullition, on a bit of crystallized alum being dropped into the flask a great portion of the water will be blown out of it, which action I refer to the rapid conversion of the low-pressure, or negatively-electric, steam, into high-pressure, or positively-electric, steam, by the evolution of electricity from the alum during its decrystallization; and the interest of the experiment is much increased by the use of a tubulated retort having its neck immersed in water, when a sound is produced similar to that of high-pressure steam escaping in water.

"Water crystallizes under the influence of 'cold,' and ice, during its decrystallization with salt, produces a most intense 'cold;' if into such a freezing mixture a copper coil be placed, and that coil be connected by a fine copper wire, with a solution of alum at the other end of the room, eight or ten feet off, the decrystallizing ice will rapidly cause the crystallization of the alum. Rain also brings down free electricity from the clouds, and, during its formation, or of that of snow, the thermometer rises.

"Assuming, then, that gases, like all other matter, are subservient to the universal law of gravitation, and that vapour undergoes decomposition during evaporation, there must be, at the uttermost bounds of the atmosphere, the gases of vapour, carburetted hydrogen and nitrogen, which, of course, arrange themselves according to their relative specific gravity, and we should therefore have:—

Gases of vapour	Oxygen .. / Hydrogen	Water	or, together,
Carburetted hydrogen	Carbon ..		
	Hydrogen / Nitrogen	Ammonia	

would form a compound, which, on its decrystallization, resolves itself into water, ammonia, and carbon; and we are informed by no less an authority than Liebig that both snow and rain-water invariably contain ammonia; and that rain always leaves its black cloud behind or above, whilst snow never does, is sufficiently evident. It is also well known to farmers that a heavy fall of snow does the ground as much good as does a dressing of manure.

"It must also be obvious that if gases be subservient to the law of gravitation, and which Nature proclaims them to be, the oxygen abstracted from the atmosphere by combustion and respiration cannot be restored by trees, as is universally supposed to be the case; but that trees and other vegetable productions, not requiring ammonia for their growth, must regenerate the air by the decomposition of water, carbonic acid, and ammonia, and the appropriation to themselves of the hydrogen and carbon, and a portion of the oxygen; and, therefore, every particle of ammonia that is so decomposed must obviously be so much lost to the animal kingdom.

"With the increase in the production of nitrogenous matter, whether animal or vegetable,

* See my pamphlets of 1845 and 1847.

there must be a corresponding decrease in the amount of wood, and, therefore, the constantly increasing demand for nitrogen, and decreasing means of restoring it to the air, both consequent on the increase in the animal kingdom, must cause an absolute diminution of the atmosphere, there being no other source from which it could be obtained; so that generations to come, however rapidly they may multiply, will find inexhaustible resources for food in the coal-beds, atmosphere, and ocean. The idea, therefore, of the production of food being dependent on the extent of land, appears to me to be absurd, it being obviously referable to the amount of matter or manure; and if in this country, where such a vast amount of coal is being consumed, and, consequently, a corresponding proportion of carbonic acid generated, and nitrogen liberated, we are not in a condition to export food, it is because our agricultural operations have been directed more by the influence of prejudice or first impressions than by a careful inquiry into the simple but beautifully harmonious manner in which our Maker accomplishes his purpose, and which is so evidently manifest in his works.

"Assuming that my views of the formation and decomposition of organic matter are correct, and which our beds of coal and of anthracite I think clearly indicate them to be, they should enable us as readily to comprehend what has taken place since the Creation, as if it occurred at the present time, and to trace, step by step, the several changes through which the atmosphere must have pssed.

"Assuming, also, that, when our system was launched into eternity, this portion was in what is termed a highly-heated state, and that it was accompanied by the matter now constituting the coal-beds, ocean, and atmosphere; steam, carbonic acid, and nitrogen must have surrounded this globe.

"The vapour by condensation into drops, or acquisition of electricity in the upper portion of the then atmosphere, and by regeneration, or parting with its electricity near the surface of the earth, would ultimately reduce the temperature of the latter, or raise its electrical condition sufficiently to admit of contact, when, as a matter of course, oxides would be formed, and some of these would be as rapidly converted into carbonates; and there is unquestionably required some more rational theory of the formation of the inorganic deposits of carbonate of lime than that of lime being taken up by boiling water, and deposited whilst cooling, since hot water does not hold so much lime in solution as cold water does.

"The constant action of the water on the surface of the earth would ultimately 'reduce its temperature' sufficiently to admit of the formation of lakes, &c.; and the contraction that would attend such reduction of temperature, or increased electrical condition, would naturally cause the formation of inequalities, by forcing out from the interior liquid matter equal to the contraction of the exterior.

"Plants thrive most luxuriantly in an atmosphere of carbonic acid and vapour; and, as when the surface of the globe was first covered with vegetation its 'temperature' must have been high compared to what it now is, the increase in the vegetable kingdom must have been rapid in the extreme; and, as carbonic acid arrests the decomposition of matter, there can be no difficulty in comprehending how the immense masses of coal that exist in almost every portion of the globe were formed.

"Vegetable matter, however, contains a certain amount of oxygen, and this, during its transformation into coal, would combine with the carbon and form carbonic acid, liberating a corresponding amount of carburetted hydrogen; hence the chokedamp and firedamp of our coal mines; and I consider burning springs to be the best possible evidence of there being large beds of coal from whence they arise. I consider, also, the existence of coal formations to be conclusive evidence that water does not undergo decomposition during the decomposition of organic matter, since, if it did, it would have assuredly effected the entire decomposition of the vegetable kingdom as soon as it lost the principle of life, particularly under the influence of such a 'high temperature,' or low electrical condition.

"During the production of this immense mass of vegetable matter, great quantities of oxygen must have been evolved, and being lighter than carbonic acid, and heavier than nitrogen, ranged itself between those two gases, and when the whole of the carbonic acid was consumed, or converted into coal, rapidly effected the decomposition of matter, and produced the anthracite, which, I believe, has never been found below a bed of coal, but always, comparatively speaking, near the surface of the earth.

"During the decomposition of vegetable matter in water under the influence of free oxygen, the whole of its hydrogen is converted into carburetted hydrogen; and the growth of plants, by the decomposition of water and of carbonic acid, causes the evolution of much electricity.

"An improved electrical condition of the atmosphere surrounding the earth would naturally induce evaporation, or the decomposition of moisture, and, agreeably to the theory already broached, about this time or period, must have commenced the formation of rain or snow.

"The then atmosphere being composed entirely of nitrogen, of the hydrogen evolved by the oxidization of metals, of carburetted hydrogen, and the elements of moisture, the snow or rain formed would naturally be rich in ammonia, which, by decomposition by the vegetable kingdom—there being then no nitrogenous matter—must rapidly have formed our atmosphere, by the combination, under the influence of electricity, of its nitrogen with a portion of the oxygen of the water and carbonic acid, also decomposed by vegetation.

"This brings us to the present period, that of the creation of the animal kingdom; and now that man, in the exercise of his reason, is rapidly consuming the coal formation, the atmosphere must be on the decrease at a ratio proportionate to the formation of nitrogenous matter. What will take place when all the coal-beds shall have been converted into living matter it would be indeed difficult to conjecture, and possibly need not much trouble the present generation.

"It is considered by some that coal formations are now being made; but as the oxygen liberated by the vegetable kingdom, agreeably to the law of gravitation, falls to the earth, and is soluble in water to a far greater extent than is atmospheric air, which is not decomposed by non-nitrogenous vegetable matter, it is quite clear that no such formation can possibly take place; and, if turf be burnt, it will be found to partake more of the properties of anthracite or culm than of coal, by yielding little gas."

[*To be continued.*]

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXV.

(LECTURE XCVIII.)

VEGETO-ALKALIS—(*Continued*).

OPIUM.

Opium is the juice of the head of the poppy (Papaver somniferum).

There exists no doubt regarding the source from which opium is derived, but considerable difference of opinion prevails respecting the mode of its extraction from the poppy: some writers maintain that the opium is extracted entirely by means of incisions made into the ripe poppy-heads; others assert that to the juice thus obtained by exudation is added that obtained subsequently by subjecting the heads to the action of the press, and even the extract furnished by the decoction of the heads in water. No doubt different processes of extraction are adopted respectively in every locality, and this circumstance, joined to the effect resulting from difference of climate and soil, fully explains the dissimilarity which we observe between the various sorts of opium of commerce. So considerable are these differences that some sorts of opium are inferior to others in medicinal properties in the ratio of 1 to 3.

In the European market we distinguish three sorts of opium, viz.:—

Smyrna opium,
Opium of Constantinople,
Opium of Egypt or Alexandria.

SMYRNA OPIUM.

This sort comes into the market in soft lumps, of greater or less bulk; the surface of these lumps is covered with numerous rumex seeds. They are light-coloured inside, but upon exposing the broken or cut surfaces to the air they acquire a dark colour. The smell of Smyrna opium is strong, and indicative of the venomous properties of the substance. The taste is bitter and acrid. This is the best sort of opium; it contains 6.9 per cent. of morphia.

OPIUM OF CONSTANTINOPLE.

This sort is brought into the market in regular flat loaves or cakes, covered with a poppy leaf. It is drier than the Smyrna opium, and frequently even brittle. It gets soft in the hand, and furnishes a light-coloured paste, which turns brown in the air. It smells like the Smyrna variety, but its odour is somewhat less marked than that of the latter. It contains 5 to 6 per cent. of morphia.

OPIUM OF EGYPT OR ALEXANDRIA.

This is the worst species of opium. It comes into the market in small, very dry, and very flat loaves, exceedingly clean at the surface, and retaining hardly a trace of the leaves in which they were originally enveloped. Its colour is dark brown; its fracture is clean and shining. It has a very feeble smell, and contains only 3 to 4 per cent. of morphia.

To these three principal species we might add the India opium, which, according to Dr. Thomson, contains three times less morphia than the Smyrna variety.

Opium has been analyzed by a great many chemists, but more particularly by Seguin, Desrone, Sertuerner, Robiquet, Pelletier, and Couerbe.

It contains:—

Morphia,
Codeïa,
Narcotina,
Meconic acid,
A brown extractive acid,
Resin,
Fatty oil,
Thebaine, or paramorphia,
Meconia,
Narceïa,
Bassorin,
Gum,
Caoutchouc,
Lignin,
A volatile poisonous principle,

and, no doubt, also vegetable albumen.

The morphia, codeïa, and a portion of the narcotina exist in the opium as saline compounds soluble in water. It is generally assumed that they are combined with the meconic acid, and in part with sulphuric acid; perhaps they form also other combinations.

Three of the constituent principles of opium are alkaline, viz., morphia, codeïa, and narcotina; four are acid, viz., meconic acid, the brown extractive acid, the resin, and the fatty oil. The remaining ingredients are neutral.

The larger portion of the narcotina does not exist in the saline state in the opium, since it may be removed by simply treating the opium with ether.

M. Pelletier has extracted from some sorts of opium another substance, to which he has given the name of *pseudo-morphia*.

The following are the principles associated in the opium with the alkaloids :—

MECONIC ACID.

This acid was discovered by Sertuerner ; but it is to Robiquet that we owe most of our knowledge of its properties. It forms white, transparent, micaceous scales. It is soluble in water. Upon ebullition it is decomposed and resolved into carbonic acid, and a new acid (comenic). On dry distillation the meconic acid yields another acid, the *pyromeconic*.

Meconic acid strikes a characteristic red colour with persalts of iron.

THE BROWN EXTRACTIVE ACID.

Of the nature and properties of this acid little is known as yet. It is most probably a mixture of different matters, and perhaps a product of alteration.

THE RESIN.

The resin of opium is nitrogenous. It is brown-coloured, insipid, and inodorous. It is softened by heat. Water fails to dissolve it; it dissolves readily in alcohol, but refuses to dissolve in ether. It is soluble in the alkalis, even in the cold. It is one of the most electro-negative resins.

THE OILY MATTER.

This matter is, no doubt, colourless in a state of purity. It is obtained usually yellow, and even brown. It is acid. Its alcoholic solution reddens litmus paper. It combines with the alkalis to soap, from which the acids separate the fatty matter again in its original state.

THE ODOROUS AND VOLATILE PRINCIPLE OF OPIUM.

We know simply that this principle exists, but we have not yet succeeded in obtaining it in the isolated state. It does not appear to exercise any considerable influence upon the medicinal action of opium.

ORIGINAL COMMUNICATIONS TRANSLATIONS, ETC.

ON THE PLANTS FROM WHICH SENNA LEAVES ARE OBTAINED.

By J. B. BATKA.

[From the *Pharmaceutical Journal.*]

As I intend to notice only the officinal sorts of senna leaves, as being by their medicinal qualities best known and distinguished, I may be permitted to make a separate genus of Senna. The fact that none of the officinal sorts actually possess the glands mentioned by Forskäl and De Candolle, and that the genus Senna is distinguished from the other species referred by De Candolle to Cassia by the peculiar form of the fruits (folliculi), their dissepimenta and seeds will justify this proceeding.

Although senna is one of the best known and most frequently employed medicines, botanists have not yet succeeded in making out the confused synonyms of the genus; and I myself should not have been able to have done so but for the abolition of the monopoly which the Government of Egypt held for so many years. This has given me the opportunity of becoming separately acquainted with the different species and their fruits, of which formerly Alexandrian senna was made up at Boulac, near Cairo. For several years past the various sorts of senna leaves with their follicles have been obtained unmixed directly from the places where they grew. Formerly the follicles were in part picked out and sold separately under the name of Folliculi Sennæ ; and, as it was not known to which leaves these isolated follicles belonged, no judgment could be formed of those which were found in Alexandrian senna. The following senna leaves are imported by us from the East :—

1. From Alexandria, under the name of Apalto Senna, the mixture consisting of three different species of senna and of the Cynanchum Argel, discovered by Nectoux and Delile.

2. From Mecca, by way of Alexandria, the well-known narrow-leaved Senna.

3. From Syria, by way of Aleppo, the obovate leaves.

4. From Tripoli, the mixture of two species, first discovered by Nees and myself.

5. From the East Indies, the narrow-leaved wild-growing Mecca Senna, and the Tinevelly Senna grown from seeds.

The description of Alexandrian senna is found in every class-book. But, as it contains the three principal species of all officinal senna leaves, it is important that I should give their botanical analysis and their special diagnosis ; and also examine the prevailing opinions respecting them.

Having, during my long residence in Trieste, bestowed great attention upon this subject, and afterwards received the communications of my lamented friend Sieber, and seen with great interest the beautiful specimens of Ehrenberg in Berlin, where I was assisted by the advice of my friend Hayne, and having lastly examined in Paris Delile's plant in company with Delile himself, I felt the importance of also inspecting Forskäl's plants in Copenhagen. My late friend Professor Schumacher, who resided there, had for some time been engaged with the examination of the same subject, and we examined together the specimens from Forskäl's own hand, contained in the herbarium of Vahl. There we found Cassia Senna, identical with the plant of the same name, which I had seen in the herbarium of Linnæus; further C. angustifolia, Vahl, with the inscription C. lanceolata, in Vahl's own hand. This I found identical with that in Wildenow's Herbarium in Berlin. The real lanceolata of Forskäl, however, we did not then find. During my last journey I looked over the different species of cassia in the British Museum, and again found that the English are the best conservators of botanical treasures, for there I found at last, to my great astonishment, what I had so much missed in Copenhagen, namely, a perfect specimen with fruits of the narrow-leaved senna, with the inscription C. lanceolata (probably written by Sir Joseph Bankes, for by Forskäl's hand C. Senna only was written on it). In this no glands could be discovered; the leaves were somewhat more developed, but the whole habit perfectly agreed with that of C. angustifolia, Vahl. Besides this there was also a specimen of C. ligustrina, Forskäl, with the glands but without fruits. The dispute about the glands was the cause of the quarrel between Delile and De Candolle, and I cannot help agreeing with the first in denying the presence of glands in the officinal species ; for, in spite of many and laborious examinations of whole bales of stalks, I have as yet not been able to discover among senna leaves in commerce stalks with glands. It was necessary, in the first place, to establish this fact ; and I corresponded, therefore, lately with Professor Vahl, in Copenhagen. He sent me a leaf of a plant possessing glands, C. lanceolata, Forskäl, and upon which Forskäl is said to have written with his own hand Surdud Senna. Judging from the leaf, this plant is C. ligustrina, and it is very probable that Forskäl only wrote the above-mentioned name from oversight. It is, however, much to be regretted that this mistake crept into his "Flora Ægypt. Arabica," and thus to the detriment of science has been promulgated in every manual. The leaves of this C. ligustrina are very like those of Tinevelly senna, but somewhat more pointed and (almost imperceptibly) finely ciliated at the edge. The fruit is a narrow, scymitar-shaped, curved, yellowish pod (Legumina linearia incurva), very different from the officinal folliculi, and consequently not belonging to senna. The fruit I saw for the first time in the specimen preserved in the Linnæan herbarium. Whoever has not seen and closely examined this plant may easily mistake it for the full-grown Mecca and Tinevelly or East India senna.* The mistake of Forskäl, therefore (who had manifestly not seen and collected this plant when in fruit), may be readily excused; I cannot, however, omit to correct his mistake publicly.

The glands of the C. ligustrina are quite different from those which Nees has erroneously depicted as glands in the C. lanceolata, in the collection at Düsseldorf, and which Nectoux and Persoon, who were equally mistaken, also declared to be glands; for they are not glands, but only two hairy stipulæ subulatæ at the basis of either side of the petiole of the C. acutifolia, as in many other species of Cassia and Wisteria.* The glands of C. ligustrina and C. glandulosa L., on the other hand, arise at $\frac{1}{4}$ or $\frac{1}{2}$ inch distance from the bases, on the common petiole, from the hairy midrib, in the form of a small fungus of the size of a pin's head, with a yellow stem and brown cap.

If we now pass to the principal question, Forskäl's plant as C. lanceolata, we find that (taking the specimen in the British Museum as the prototype) it is identical with C. angustifolia, Vahl, and with Mecca and Indian senna leaves, and I therefore declare it to be Senna angustifolia,† which, as is well known, forms a part of the Alexandrian senna leaves. By this, therefore, the incorrect description of Forskäl, in his "Flora Ægypto-Arabica," the less accurate synonym C. lanceolata, and, above all, the error of De Candolle respecting the glands, are got rid of; for C. acutifolia, Delile, cannot be confounded with it without further mistaking it for Senna acutifolia. It remains the original officinal species of Sennaar, and is distinguished by the more elliptic form of the slightly hairy midrib, and by its peculiar smell and acrid taste. I examined Dr. Kotschy's very perfect and beautiful specimen sent in 1840 from Sennaar to the British Museum, the smooth, brownish-green follicles contained between the dissepiments showing wrinkled seeds with yellowish seed-lobes and an enamel-like coating. Nees, in the collection of Düsseldorf, has erroneously mixed this species with C. senna and C. lanceolata, and thus only increased the confusion of the synonyms of these otherwise beautifully and correctly depicted plants.

C. Senna of Linnæus is the third species of which the Alexandrian leaves are composed, and, out of respect for the authority of old Linnæus, by many ancient botanists considered as the prototype of the same. I can only consider it as the vehicle of all mistakes, which this name is intended to conceal. Most previous botanists have done the same (as Forskäl did with Ligustrina and Lanceolata) when tired of further examinations. I have found it identical with C. obtusa, Roxburgh; Obovata, Colladon; Obtusata et obovata, Hayne. The leaves of this species vary much in form ; all the more fully-grown leaves are at the top broadly blunted (obtusata) and retuse (retusa), whilst the younger leaves present this characteristic less distinctly, and are more ovate (subovata, obovata). In commerce this species has been very correctly named from this latter character, and I shall therefore call it S. obovata. The climate in which the Senna obovata grows imparts to the leaf its peculiar consistency. The colour of the leaves is brownish green; those from Tripoli have a more delicate parenchyma than those from Saida and Aleppo; those from Senegal are thicker and more like leather. The smell of these leaves is inconsiderable; their taste when chewed, mucilaginous and herbaceous; the dark green follicles, when ripe, have a contracted kidney-like form ; the unripe ones, however, have a more bottle gourd, rounded form, and after the production of the seeds, which are somewhat torulose, have crest-like vertical pro-

* This appears to have been the case with Schrank, in his treatise ("In Acad. Monac.") with ligustrinoides.

* As Delile, Bennet, and I regard them.

† Thomson, in 1828, regarded it in his "London Dispensatory" as the original plant of Senna mekly (Mocha).

tuberances projecting in the middle, and the seeds have very yellow-coloured cotyledons.

That Cynanchum argel materially increases the smell of the Alexandrian leaves, and is, therefore, intentionally mixed with them, is now an established fact; the pale green leaves, whitish blossoms, and blackish fruit of this plant, which are found among the so called officinal leaves (as imported by us), sufficiently mark their presence; and, in order to suppress entirely this adulteration, I propose to cease buying this Alexandrian commercial sort till the practice is given up.

The narrow-leaved Mecca senna, which I have designated Senna angustifolia, is mixed with the small felty leaves of a tender plant, which I discovered in it some time since; and, having recently received it from Delile as a variety of his C. acutifolia, I now take the liberty to introduce it as Senna tomentosa. This plant is no shrub, but, like the Mecca and Tinevelly senna, merely an herbaceous plant. It has, therefore, only very delicate but not lignceous stalks, like the Senna acutifolia and obovata. It is impossible, in my opinion, to regard this Senna tomentosa as a variety of Acutifolia, for not only the felt-like leaves and fruits, but also the whole habit, is much more delicate and different, while the leaves are considerably smaller, and of a more oval form, which certainly possesses a small point (mucro) but no bird's-tongue-like appearance, as Senna acutifolia. Delile accounts for this by assuming that the hairy character is neither constant, nor a safe criterion when the leaves and fruits are perfectly developed, and I myself do not consider it of great importance; but still in one and the same bale of Mecca senna these leaves and fruits are found in several stages; and although the fruits, if the seeds be perfectly ripe, have actually lost the blackish colour and part of the yellowish hair, still their upper suture always remains, as I have had frequent opportunity of satisfying myself, and, contrary to what is the case with the follicles of Senna acutifolia and Angustifolia, distinctly ciliated with fine hair; and likewise the leaves even when full grown (5—6‴ long and 3—3$\frac{1}{2}$‴ broad) are always felt-like and furnished with whitish hair. Darnaud sent this plant in 1843 to Delile from the valley of Dumrich, in Nubia; but Boré had previously discovered it in Arabia, and the bale which I examined had been imported from Yemen (in Arabia). At first I took these delicate small hairy leaves to be another sort (Tephrosia apollinea) found in the Tripoli senna, and which I had already met with in 1828; but I soon convinced myself, by examining the fruits mixed with it, and comparing it with Darnaud's specimen, that it was a real senna.

The Tripoli leaves consist, according to my examination, of Senna acutifolia, S. obovata, a trifling addition of S. angustifolia, and occasionally, as I found in 1828 and again in 1840, of the leaves of Tephrosia apollinea, which, not being as constant as the adulteration of the Alexandrian leaves with Cynanchum argel, I am inclined to consider as accidental. This plant is perfectly well figured in Delile's "Flore d'Egypte," page 144, and described by him as Galega; the delicate hairy leaves are soft, green, oblong, ovate, and, therefore, not easily to be distinguished from those of S. obovata, if this were not facilitated by the narrow, yellowish, hairy pods which I found among them. I sent it at that time to Nees, who confirmed my views, and mentioned this adulteration at the meeting at Düsseldorf.

I now come to the fifth commercial sort, viz.:—

The East Indian senna, which I consider as ident cal with that cultivated by Mr. Hughes in Tinevelly, near Calcutta; and, therefore, in consonance with Royle and Wallich, I admit it as Senna angustifolia, the first of whom showed it to me beautifully drawn as Lanceolata, Forskäl, in his "Illustration of the Botany of the Himalaya Mountains." It appears that by care and cultivation the leaves of S. angustifolia here become broader and longer, for this Tinevelly senna is exactly one third wider and longer than the leaves of the same species of senna growing wild in the East Indies and in Arabia. The colour is also deeper green, which, however, arises from the care taken in drying them; for, whilst the senna in Tinevelly is cultivated, and the leaves, like those of tea, gathered only when perfectly developed, the Indian gatherer mows the wild-growing leaves (whilst yet imperfectly developed, and, therefore, whilst narrower and smaller) like hay with us, and leaves them all exposed to the air and moisture; and whilst they are yet for the most part not dry they are pressed together in bales, where they undergo a fermentation. This is distinctly shown by the burnt black, and, by the oxidation of the cathartin, yellow leaves. The proof that this colour is not the natural one is furnished by the fact that the above-mentioned Tinevelly leaves, and the more carefully collected pure Yemen and Mecca leaves, which come from the same plant, are, since the abolition of the monopoly, received direct from these parts in a more beautiful condition than were formerly procured by way of Cairo. They are also justly to be preferred to those East Indian yellow leaves; for, although Pomet, in his work written in 1688, prefers the yellowish senna leaves to all others, still he would have rejected them, because they represent as narrow-leaved senna (de la pique) the Mecca leaves, against which he pronounces, without further examination, the anathema, as well as against the green leaves (obovata) from Tripoli and Saida, with the intention of praising above all others the Alexandrian leaves, which were at that time probably not so much mixed with other leaves and the Cynanchum as now.

It was only after long-continued personal examination and inspection of the dried original plants that it has been possible to elucidate finally this obscure part of the materia medica; and I shall consider myself very happy if I have succeeded in this task.

SENNA.

Familia Leguminosæ, tribus Cassiæ. Decandria Monogynia. Calix pentaphyllus, petala quinque æqualia; antheræ supremæ tres steriles, infimæ tres radiatæ filamentis longioribus incurvis, petiolis eglandulosis, foliolis basi obliquis. Folliculi oblongi vel reniformes, lati, plano-compressi, margine membranaceo. Semina (parietalia, cum dissepimentis) cordata, tunica torulosa. Podospermio, sutura supera et hilo ovali conjuncto, cotyledonibus flavis, radicula et plumula coronatis.

1. *S. obovata.* Foliis pinnatis, tri-quatuor vel quinquejugis, foliolis obovatis retuso-rotundatis, mucronatis, basi angustioribus; folliculo supra semina verticaliter interrupto cristato. Seminibus verticaliter torulosis.

Syn: Cassia senna, Linnæi, sp. pl. 1, p. 559. Nectoux "Voyage d'Egypte," tab. 1, page 19. Burmann, "Flor. Ind.," page 96, t. 33. Sieber "Flora Ægyptiaca," et Delile "Flore d'Egypte," fol. 420.

Cassia obovata et obtusata, Hayne. "Düsseldorfer Abbild. Consp.," 347.

Cassia obtusa, Roxburgh, "Flor. Ind.," 2, p. 344.

Cassia portoregalis, Bancroft.

Cassia senna, Lam. ill. 1, 332.

Cassia obovata, Colladon, "Hist. des Cass.," p. 92.

Cassia senna Italica, Linn., sp. pl. ed. ii., i., p. 539.

Frutex habitat in Syria, Ægypto, Senegalia, Tripoli et India.

Senna de Aleppo in commerc. dicta.

2. *Senna angustifolia.* Foliis pinnatis, quinque septem-jugis, foliolis angusto-lanceolatis, glaberrimis subæqualibus, folliculis planis compressis oblongis et reniformibus.

Synon.—Cassia angustifolia. Vahl. Symb. Willdenow in "Herb. Berolin."

Cassia Senna, Dr. Wallich, missa in "Horto Botanico Calcuttæ Colitur."

Cassia Indica, Schumacher "Plantelare," t. i., page 577.

Cassia elongata, Lemaire Lisancourt.

Cassia acutifolia, Düsseldorfer Sammlung exclus. "Synonymis Consp., 346.

Cassia lanceolata, Forskäl, in Mus. Britan., exclus. description in "Flor. Ægypt. Arab.," page 85, No. 58.

Cassia lanceolata, Dr. Royle, in the "Illustration of the Botany of the Himalayan Mountains," tab. 37.

Cassia lanceolata, "Herb. Wightii," No. 654 in Mus. Brit.

Habitat in Arabia, in Lohaya, Mecca, Yemen, et in India. In Calcutta, Tinevelly prope colitur.

Senna de Mecca in commerc. dicta.

3. *Senna acutifolia.* Foliis pinnatis quinquejugis stipulis linearibus subulatis et pilosis ad basin petiolorum, foliolis ovato-acutis æqualibus nervo medio in adolescentibus piloso: folliculis oblongis plano-compressis.

Synonym: Cassia acutifolia. Delile "Flore d'Egypte."

Cassia lanceolata. Düsseldorfer, Sammlung, exclus. "Synonym. Consp.," 345.

Cassia lanceolata. Dr. Kotschy, in Mus. Brit., No. 315.

Frutex habitat in Ægypti et Sennaar. Cassia Alexandrina. Miller.

Senna Alexandrina et officinalis in com. dicta.

4. *S. tomentosa.* Foliis pinnatis quinquejugis foliolis parvis ovato-oblongis, pilosis mucronatis, folliculis adolescentibus nigris, velutinis; maturis sutura superiori pilis albidis ciliata.

Synonym: Cassia ovata, Merat et Lens? Cassia acutifolia varietas tomentosa Delile.

Habitat in Arabia et Nubia, inter folia Sennæ Meccensis ab auctore detecta et a clariss. Boré in Arabia et a clariss. Darnaud in Valle Dumrich in Nubia collecta.

Senna de Mecca in commercio dicta.

ON THE INORGANIC CONSTITUENTS OF ORGANIC BODIES.

By H. ROSE,

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[*Continued from page 55.*]

METHOD OF EXAMINING THE INORGANIC CONSTITUENTS OF ORGANIC SUBSTANCES.

Vegetable substances are first freed as completely as possible from all foreign admixtures; solid animal matters are exposed to a gentle heat to remove the greater part of the water they contain; and animal liquids are to be evaporated to dryness at a gentle heat. In this state the substances are placed in a Hessian crucible, the lid of which is furnished with a hole in the middle, the joints between the lid and the crucible are carefully luted with clay, and the crucible then placed for a long time in a hot place, and, if possible, all the remaining moisture expelled. It is then exposed to a moderately strong heat in a wind-furnace in a charcoal fire; the gases which escape through the hole are inflamed, and when the flame has burnt out, and no more gases are evolved, the hole is closed with an accurate stopper of chalk, the crucible heated at a very low red heat, and then allowed to cool with perfect exclusion of the air.

The examination of the carbonized mass resolves itself into three parts.

Part I.—The carbonized mass is first powdered as finely as possible, then boiled for a long time with water in a platinum dish, filtered and washed with hot water until a few drops of the filtering liquid leave a slight residue only, when evaporated upon platinum foil. It is scarcely possible to continue washing the mass until the liquid which runs through leaves no residue, because a little phosphate of lime is always dissolved. It is therefore best, when the residue obtained on evaporating the water used in washing is very slight, to test a few drops of the water which runs through with solution of nitrate of silver; if a slight opacity only is produced, which disappears on the addition of nitric acid, this arises from phosphate of lime in solution, and we may be certain that all those constituents which are soluble in water have been removed. If the turbidity does not disappear on

the addition of nitric acid, this arises from the water used in washing still containing some chlorides, and the washing must be continued longer.

On boiling the carbonized organic substances with water, as also on evaporating the aqueous extract, I have never been able to detect the evolution of ammonia. Hence, during the carbonization, neither alkaline cyanides nor alkaline cyanates are formed.

In all those substances which have hitherto been examined the aqueous solution contained chlorides. If the amount present is small the carbonized mass is easily washed; but if they form a principal constituent the carbonized mass frequently requires to be washed for several weeks.

It sometimes happens that the aqueous solution appears of a brownish colour, which depends upon the imperfect carbonization of the substance. Usually the liquid becomes decolorized on concentration, and deposits woolly flakes of carbon, which may be easily separated by filtration before other substances are deposited from it.

If alkaline carbonates exist in the aqueous solution in any considerable quantity, frec alkali is formed by the action of the carbon upon the alkaline carbonate, with the evolution of carbonic oxide. If the aqueous solution be evaporated the dry mass contains more or less hydrated alkali with alkaline carbonate. By means of a solution of nitrate of silver we may readily convince ourselves of the decomposition of the carbonic acid in the alkaline carbonates by carbon, since, unless the mixture has been exposed to a very great heat, this reagent does not produce a pure white precipitate in the filtered aqueous solution, but a more or less brownish precipitate is formed, which contains oxide of silver as well as the white carbonate of silver.

Decomposition of the alkaline carbonates ensues principally when the organic substance during its carbonization evolves a very large quantity of olefiant gas. Hence it takes place to a great extent when such seeds as contain a large amount of a fatty oil are carbonized, as rapeseed; it occurs to a much less extent on the carbonization of other seeds which do not contain any remarkable quantity of fatty oil, as peas, and likewise with the herbaceous parts of plants.

Unfortunately my attention was not directed to this circumstance until all the experiments were entirely or partly finished. The alkali among the constituents of the aqueous extract is, therefore, assumed as existing in the state of hydrate.

It is, therefore, advisable to pass a current of carbonic acid gas through the aqueous solution before evaporating it, so as to convert the hydrated alkali into the state of alkaline carbonate.

The aqueous solution is then evaporated to dryness in a platinum capsule. It usually happens that when the liquid is very concentrated it becomes more or less turbid from the separation of phosphate of lime which was in solution. When the liquid has been evaporated to a small volume the phosphate of lime which has separated may be removed by filtration: it is, however, difficult to free the aqueous solution from it perfectly in this way; in fact, in some cases it cannot be done, especially when it contains a large amount of silica, which also separates on the concentration of the liquid. It is, therefore, best to evaporate the whole of the liquid to dryness, and to separate the phosphate of lime in the course of the analysis.

The residue is moderately heated until its weight remains constant. If it be heated too strongly decomposition of the carbonates contained in it may readily occur, as when silica and phosphates are present carbonic acid is expelled, which in fact partly occurs, according to Heintz, during evaporation. After determining the weight of the dry residue of the aqueous solution it is analyzed as follows:—

The quantity of carbonic acid is first estimated by means of pure nitric acid in a suitable apparatus. This is obtained by the loss in weight of the apparatus. If during this operation the silica has become separated in the acid liquid, it is removed by filtration, and the chlorine precipitated from the filtered liquid by solution of nitrate of silver. The excess of silver is removed from the liquid after the separation of the chloride of silver by muriatic acid, and it is then evaporated to dryness in a porcelain capsule. The dry residue is moistened with muriatic acid and treated with water. Some silica usually remains undissolved, which, when added to that previously obtained, gives the whole amount contained in the aqueous solution.

The liquid separated from the silica is treated with ammonia, by which the entire amount which has been taken up by the water is precipitated. It is filtered, washed, dried, heated to redness, and weighed. Its weight, when deducted from that of the residue after evaporation to dryness, yields the true weight of the aqueous extract. It is mixed with the carbonized mass which has been exhausted by water.

The liquid is then treated with oxalic acid. In very few cases only is a precipitate of oxalate of lime thrown down: in most cases it is not so. The oxalate of lime is determined as carbonate by the ordinary method.

The filtered liquid is then treated with a solution of chloride of barium. The precipitate consists of phosphate, sulphate, and oxalate of baryta. It is filtered and washed. Although the oxalate of baryta is not very difficultly soluble, yet after a little practice we can readily judge when the washing must be discontinued. It is therefore advisable, on precipitating the lime, not to add too large a quantity of oxalic acid, so as to avoid obtaining a too copious precipitate of oxalate of baryta.

The precipitate is treated with dilute muriatic acid. Sulphate of baryta is then left undissolved, and its weight must be determined after it has been washed. We thus estimate the amount of sulphuric acid. The muriatic solution of the barytic salt is treated with sulphuric acid, and the precipitated sulphate of baryta separated by filtration. It is then supersaturated with ammonia and muriate of ammonia, and sulphate of magnesia added to precipitate the phosphoric acid. Its weight is calculated from the phosphate of magnesia, after having been heated to redness.

The liquid from which the insoluble barytic salts have been separated by chloride of barium still remains to be examined. The excess of chloride of barium is decomposed by carbonate of ammonia. If the liquid is very dilute, it must be previously concentrated by evaporation. The carbonate of baryta is separated by filtration, the filtered liquid evaporated to dryness, and the dry residue carefully heated to redness, to expel the ammoniacal salts. The remaining mass consists entirely of alkaline chlorides. These are separated in the ordinary way by chloride of platinum. The amount of potash is determined from the weight of the ammonio-chloride of platinum. The amount of chloride of sodium may be calculated from the loss; but it is better to determine it directly as sulphate of soda.

Part II.—This part of the investigation is commenced by boiling the carbonized mass, which has been exhausted by water, with muriatic acid for a long time; it is then filtered and washed with hot water, to which a little muriatic acid has been added, until a few drops of the water used in washing leave no residue when evaporated upon platinum foil. The filtered liquid is evaporated nearly to dryness in a platinum capsule. The weight of the dry residue cannot be determined, on account of the readiness with which the chlorides of iron and magnesium are decomposed by heat. The alkalis usually existed in the dry residue as chlorides, whilst they were contained in the exhausted carbonized mass in the form of phosphates; for when the carbonized mass has been washed with water, and a portion of the latter is treated with nitric acid, no precipitate is produced in this solution by solution of nitrate of silver. In arranging the constituents of the muriatic solution their sum must be taken, and the alkalis represented in the state of oxides.

I was at first much astonished at finding alkalis present in the muriatic solution, as I had no reason to believe they existed in it. Subsequent investigations, however, which I shall describe in a future paper, have shown that, when pyrophosphate of lime and pyrophosphate of magnesia are heated with not too large a proportion of alkaline carbonates, remarkable double salts, consisting of the earthy phosphates in combination with the alkalis, are formed. Most of them are analogous in composition to the ammonio-phosphate of magnesia, but contain a fixed alkali instead of ammonia. The extremely imperfect decomposition which ensues on fusing the phosphates of lime and magnesia with alkaline carbonates depends, in most cases, upon the formation of these double salts.

Their formation is undoubtedly the cause of the quantities of the alkalis being estimated incorrectly, and in too small proportion, in many investigations on the determination of the inorganic constituents of organic substances, because their presence in the muriatic solution could not have been expected.

The mass obtained by evaporation is moistened with muriatic acid and then treated with water. Usually a small quantity of silica remains undissolved, which is separated by filtration and its weight determined. The liquid is then neutralized with ammonia. The precipitate contains phosphoric acid in combination with lime, magnesia, and peroxide of iron. It is well known that when phosphate of magnesia has been heated to redness, and is then dissolved in an acid, it cannot be completely precipitated by ammonia; the error, however, arising from this source is of only slight importance, because the carbonized mass has been heated for a very long time with muriatic acid, by which means, as is well known, the pyrophosphate of magnesia is almost entirely converted into the *c*-phosphate of magnesia. The extremely small quantity of magnesia which remains in solution is, however, determined in the further progress of the analysis.

The phosphates which have been precipitated by the ammonia are dissolved in nitric acid, and treated with mercury to separate the phosphoric acid from the bases. The dried mass is treated with water, and the mercurial salt removed from the solution by muriate of ammonia and ammonia; the lime is then precipitated by an alkaline oxalate, and the magnesia by phosphate of soda. When peroxide of iron is mixed with the earths, it is separated by the usual methods. The insoluble mercurial residue containing phosphoric acid is fused with carbonate of soda, and the fused mass treated with water. Should any peroxide of iron then remain undissolved, it is separated by filtration, dissolved in muriatic acid, and precipitated by ammonia. The liquid which has been separated from the peroxide of iron by filtration, and which contains phosphate and carbonate of soda, is supersaturated with muriatic acid and then with ammonia, and the phosphoric acid precipitated by sulphate of magnesia. The amount of phosphoric acid is calculated from the weight of the ammonio-phosphate of magnesia after it has been heated to redness.

By the analysis of the phosphates precipitated by ammonia, the composition of the precipitated phosphate of lime, and the presence or absence of the perphosphate or pure peroxide of iron in the precipitate, may be determined. The liquid filtered from the earthy phosphates contains either alkalis and phosphoric acid only, as is the case in the examination of all seeds and animal matters, or it contains lime and magnesia only, and these frequently in very considerable quantities. They existed in the carbonized mass in the form of carbonates; but it is only in those cases in which they are present in considerable quantities, as in the analyses of the straw of peas and rape, that a very distinct evolution of carbonic acid can be perceived on treating the carbonized mass, after exhaustion with water,

with muriatic acid. As the carbonic acid cannot be determined directly, it is calculated from the quantity of lime and magnesia found in the liquid filtered from the carthy phosphates.

In the analysis of the carbonized mass of vegetable seeds and animal substances, where, as has been previously mentioned, the liquid filtered from the earthy phosphates contains both alkalis and phosphoric acid, this is treated with chloride of barium; phosphate and, when sulphuric acid is present, sulphate of baryta are then precipitated. Sulphuric acid has, however, very rarely been found in the muriatic extract of the carbonized mass. The phosphate of baryta is separated by filtration, dissolved in muriatic acid, the baryta precipitated from the solution by sulphuric acid, which is then supersaturated with ammonia, and the phosphoric acid precipitated as ammonio-phosphate of magnesia.

The liquid which was separated from the phosphate of baryta contains the alkalis. The excess of baryta is removed by carbonate of ammonia, the filtered solution evaporated to dryness, and the dry mass heated to redness to expel the ammoniacal salts. The alkaline chlorides left are separated by chloride of platinum.

The examination of the second portion can be considerably simplified when sulphuric acid is absent. The muriatic extract is carefully evaporated. If it contains silica, the dry mass is moistened with nitric acid, and the silica separated; mercury and nitric acid are added to the filtered liquid; it is then evaporated to dryness with excess of mercury in the ordinary way, and the bases separated from the phosphoric acid by water.

This simplified method has, however, two disadvantages. The large amount of chlorine present produces a large quantity of protochloride of mercury, which remains mixed with the protophosphate of mercury; hence this insoluble mixture requires a large quantity of carbonate of soda for its decomposition. The second disadvantage is, that, when the earths form the principal constituents of the acid extract, it cannot be accurately determined whether they are combined with phosphoric or carbonic acid.

Part III.—This part of the investigation comprises the determination of the inorganic constituents existing in the carbonized mass after exhaustion with water and muriatic acid, or rather which are produced by oxidation.

This incineration of the carbonaceous mass is accompanied by no small difficulties. I formerly effected it by heating it to redness in a crucible, the lid of which was perforated, and a silver tube, which conducted a current of oxygen to the heated mass, was fitted to the aperture. The incineration succeeded perfectly in this manner; but in a very large number of cases it was impossible to incinerate the carbonized mass merely by the access of atmospheric air without the aid of oxygen. But on combustion in oxygen gas an elevated temperature is produced, and the substance of the crucible is powerfully attacked by the phosphates formed by the oxidation. If a platinum crucible be used, it is completely spoiled when alkaline phosphates and carbon act upon it at an elevated temperature. Nor can a porcelain crucible be used, because, when the greater portion of the carbon has been burnt, the alkaline phosphates, being in a state of fusion, dissolve the glaze. This is particularly the case with porcelain crucibles of Meissen manufacture; but even those manufactured at Berlin cannot resist the action, although they are far less acted upon than the former. Silver crucibles do not stand the high temperature, and begin to melt. When the combustion of the carbonized mass is effected in a glass tube heated to redness in a furnace by a charcoal fire, it succeeds tolerably well; but the high temperature produced by the combustion of the carbon in oxygen fuses the alkaline phosphates, and they unite with the glass, so that they cannot afterwards be separated from it mechanically. The combustion was finally effected in small earthenware crucibles, which answered in every respect tolerably well, and were but slightly acted upon by the alkaline phosphates; but one important difficulty still remained unconquered,—a considerable quantity of alkaline phosphate is constantly volatilized. This is very large; and the volatilization cannot in any way be avoided when the combustion is effected in oxygen gas, even when the current is slow. When the gas was passed through too slowly, combustion did not take place; but, as soon as it was allowed to flow more quickly, the oxidation of the carbon occurred with the production of a vivid light, and white fumes were distinctly seen to ascend. For the purpose of examining the volatilized products, the combustion of the carbonized mass was effected in a tubulated glass retort, through the tubulure of which the oxygen was passed, whilst its mouth was immersed in water. The water was found to exhibit powerful reactions of phosphoric acid and alkali.

If a mixture of alkaline phosphate with a large proportion of carbon is artificially prepared, and the mixture burnt in a current of oxygen, the same phenomena as those just described are found to occur, and dense white fumes are seen to ascend.

This volatilization only occurs with alkaline phosphates. On the combustion of a carbonized substance, which after incineration yields earthy phosphates only, volatilization cannot be perceived. Moreover, when earthy phosphates are artificially mixed with carbon, and the mixture burnt in oxygen gas, volatilization does not occur, nor can any white fume be perceived. Hence the earlier experiments which were performed in my laboratory, in which the washed carbonized mass was burnt in oxygen gas, have yielded incorrect results, and must therefore be repeated, as a method has at last fortunately been discovred by which the combustion can be effected without loss. This method, which was proposed by M. Fleitmann, is as follows:—

The carbonaceous mass, after having been exhausted with water and muriatic acid, is dried, and then moistened with a concentrated solution of chloride of platinum. The moist mass is heated in a porcelain crucible or a porcelain capsule, at first gently, so that no moisture may be expelled and no loss occasioned by the spirting of the mass; then more strongly, so that it attains an incipient red heat. This is best effected in a large concave lid of a platinum crucible. If the whole be heated in a porcelain crucible, the incineration requires a far longer time, inasmuch as it takes place more slowly in proportion to the smallness of the surface and the less free contact of the air. A very slow combustion of the carbon ensues, chlorine being simultaneously developed; each carbonaceous particle becomes incandescent, just as in the scintillation of an inflamed vegetable substance. The combustion is extraordinarily increased by constantly stirring the mass with a platinum wire or a small platinum spatula. As fresh portions of the unburnt carbon come into contact with the air the scintillation recommences. The spirit-lamp may be removed, yet the carbon continues to glow for a long time; frequently, when the quantities are not too small, for several hours; even portions taken out with the platinum spatula continue to burn. The more concentrated the solution of platinum is, the more readily does the combustion ensue. When the mass ceases to glow on the continued application of heat, and still appears black, it must be again moistened with chloride of platinum. The less carbon the residue contains the more readily does the combustion ensue. If the solution of platinum is concentrated, twice moistening with the solution of platinum is not strictly requisite. After the mass has been once moistened and then heated to redness, the residue may be treated with aqua regia and evaporated, so as to render the platinum again active; however, this is a somewhat tedious proceeding. Great care must also be taken that no loss is occasioned by the spirting of the mass. As the whole of the platinum used is usually recovered, the method does not entail any pecuniary loss; it is, therefore, preferable to moisten the mass a second time with chloride of platinum.

When all the carbon has been burnt, the residuary mass is of a pure ash-grey colour. Before it is treated with muriatic acid, it must be heated to redness in a porcelain crucible in a current of hydrogen gas, so that the double compounds of the alkaline chlorides with the chloride of platinum may be completely decomposed, which can only be accomplished with difficulty with large quantities by merely heating them in atmospheric air. If the treatment with hydrogen gas be omitted, the subsequent separation of the platinum from the muriatic solution of the ash is accompanied with several inconveniences. The mass, after having been treated with hydrogen gas, is digested for a long time with muriatic acid in a flask, the residue separated by filtration, and washed with water containing muriatic acid. The resulting solution, which usually contains the same constituents as the muriatic extract of the carbonized mass, is analyzed in exactly the same manner.

The platinum remaining undissolved, which is also mixed with the sand and silica of the organic substance, may be separated from these substances by two methods. The whole is either boiled in a platinum capsule with a solution of carbonate of soda, which dissolves the silica, leaving the platinum and the sand, which may then be separated by aqua regia, or the mass is treated at once with aqua regia, when the sand and silica remain undissolved, and may be separated from each other by boiling with a solution of carbonate of soda. The silica dissolved in the solution of carbonate of soda is obtained by supersaturating the solution with muriatic acid, evaporating to dryness, and treating the residue with water; the silica then remains undissolved.

A solution of caustic potash cannot be used for separating the silica from the sand in the analyses of the ashes of vegetable substances, but carbonate of soda must be made use of for this purpose; for the sand is not in most cases pure sand, but usually consists of a mixture of sand and clay, which is either derived from the soil upon which the plants grew, or from the floor of the barn upon which the corn was thrashed, and which has been driven into the straw and the grains of seed during the process of thrashing. This clay is readily decomposed by a solution of caustic potash, the alumina being dissolved, and the amount of silica contained in the substance is rendered incorrect by the silica dissolved out of the clay. When carbonate of soda is used, this decomposition of the clay does not occur.

[*To be continued.*]

ON LIQUID STORAX AND BALSAM OF PERU.

By M. KOPP.

The author states that, having in preceding memoirs studied the resins of benzoin and the balsam of tolu, there remained to complete the general history of the balsams to examine the balsam of Peru and storax.

Balsam of Peru had already yielded MM. Frémy and Plantamour very interesting results. M. Frémy had determined the presence of cinnamic acid, cinnamein, and several resins: in some species of balsam of Peru he met with a solid crystalline matter, to which he gave the name of metacinnamein. According to this chemist, when cinnamein is submitted to the action of potash dissolved in alcohol, it is converted into cinnamic acid, and peruven, which is a liquid body.

According to M. Plantamour, there are besides formed under these circumstances cinnamic ether and a new acid, the carbo-benzoic.

M. Kopp states that his researches confirm the results of M. Frémy, but not those of M. Plantamour.

Storax has been examined with much care by M. Simon, of Berlin, who found an essential oil

in it, styrol, a crystalline body, styracine, cinnamic acid, and several resins. He stated that styracine is transformed by potash into cinnamic acid and liquid styracone.

These results are quite exact, only the author has not assigned the true composition to the isolated bodies.

The author observes that he has already shown that styrol is identical with cinnamen or cinnamol ($C_{16}H_{18}$), which is obtained by the dry distillation of cinnamate of copper, or of a mixture of cinnamic acid and caustic barytes. M. Kopp's researches also prove that great analogy of composition exists between storax and balsam of Peru.

Styracine, which may exist either in the amorphous or viscous state, or crystallized, is identical in the former condition with cinnamein, and in the second with metacinnamein. Its formula is $C_{18}\,H_{18}\,O_2$. Peruven is identical with styracone, its formula being $C_9\,H_{12}\,O$. The transformation of styracine into cinnamic acid and styracone, under the influence of caustic potash, is expressed by the following equation :—

$$C_{18}\,H_{18}\,O_2 + H_2\,O = C_9\,H_8\,O_2 + C_9\,H_{12}\,O.$$

Styracine. Cinnamic acid. Styracone.

Styracine then possesses strong resemblance to neutral fatty matters, which, under the influence of alkalis, are converted with the absorption of an atom of water into fatty acids and glycerine.

As storax is the most readily treated and least expensive of these different bodies, the author selected it for his experiments.

The first operation is to distil the storax with five or six times its weight of water, in a copper alembic furnished with a refrigeratory. An oil floats on the condensed water, which is to be poured off, dried by chloride of calcium, and distilled at 290° F.; it is then cinnamen or pure cinnamol. It is not advantageous to employ in the distillation water containing carbonate of soda in solution, for it causes the mass to rise too readily and afterwards to run over. The residue of the distillation is boiled with a weak solution of carbonate of soda, which removes the free cinnamic acid, and cinnamate of soda is formed which remains in solution. This operation is to be repeated many times, till at last, especially when the mixture cools, it becomes more and more spongy, and retains in its interstices a viscid, yellowish oily matter. The watery liquids containing the cinnamate of soda and a slight excess of carbonate, and also a little resinate of soda, are to be much concentrated, and then decomposed with excess of boiling hydrochloric acid. The greater portion of the impure cinnamic acid is deposited in the liquor in a concentrated state in the form of a heavy brown oil, which solidifies on cooling, and the aqueous liquid is filled with crystals of cinnamic acid. The resinous matter is to be removed, and the crystals, after being strongly pressed and washed with a little cold water, are to be distilled from a glass retort. The first product of the distillation is cinnamic acid nearly pure; the last products are rendered impure by empyreumatic oils. By dissolving, however, this impure acid in boiling distilled water and filtering, the oil remains on the filter, and the filtered liquor is filled with very white and perfectly pure crystals of cinnamic acid. This is the most ready and least expensive process for obtaining this acid in a state of absolute purity.

The resinous, ductile, spongy matter containing the yellow opaque liquid in its pores becomes when squeezed more and more compact, and the yellow liquid flows from it; this is to be filtered, the operation goes on very slowly, and the surface of the liquid readily solidifies. By this means a brownish-yellow oily matter is obtained, which after some time becomes a stellar crystalline mass of impure styracine. In order to purify it, it is dissolved in about ten times its weight of alcohol at 122° F.; the solution is poured off and subjected to a low temperature. The styracine then crystallizes in very fine white flexible needles. The compact resin from which the styracine has been pressed becomes hard and brittle by cooling. It still retains a considerable quantity of styracine, and it is advantageous to employ it in the preparation of styracone : there is thus obtained an additional quantity of alkaline cinnamate mixed with the resins. To effect this it is put into an alembic, with a concentrated solution of potash or soda, and distillation is to be cautiously performed. A milky liquid passes over, which, when saturated with common salt, yields on its surface a creamy matter, which gradually unites into an oily stratum; it is to be removed, filtered, and rectified. There is thus obtained a colourless liquid, which boils at 490° F., crystallizes at a low temperature, becomes solid at 46°, and has a peculiar odour. It is styracone. In the alembic there remains a blackish-brown and very alkaline liquid, in which there float numerous mammillated grains of a yellowish colour, consisting of a mixture of cinnamate and resinate of soda. The liquor may be filtered in a funnel containing broken glass; the resinate is to be washed with a little water, which, added to the alkaline liquor, may be employed to decompose a fresh quantity of storax. When water is added to the globules a resinous matter is deposited, and the solution contains much cinnamate and some resinate of soda; the cinnamic acid and the resin are to be precipitated by hydrochloric acid. These two substances are to be separated by boiling water or solution of ammonia, which does not dissolve the resins. To obtain the latter in a pure state they must be successively washed with acidulated and ammoniacal water, and lastly with boiling water. The different resins are separated by means of their different solubility in alcohol, ether, and pyroxylic spirit. They are hard and brittle, not readily fusible, and but slightly coloured.

Styracine is the most interesting substance contained in storax. It may exist in two conditions, crystalline and fusible at 100° F., and liquid, viscid, and uncrystallizable. When pure crystals of styracine have been melted, the liquid frequently does not solidify on cooling.

Sometimes also, on operating on storax, the styracine is obtained in a liquid uncrystallizable state, especially when it has been left for too long a time in contact with acids, for the purpose of separating the last traces of soda.

When styracine is treated with the caustic alkalis it combines with them, and forms a solid mass consisting of agglomerated grains. By the application of heat, styracone distils, and cinnamic acid is obtained. Submitted to the action of chlorine, chlorinated styracine is obtained. By distilling this compound under the influence of chlorine, a volatile chlorinated liquid and a chlorinated crystallizable acid are procured; the latter very readily forms salts. With nitric acid styracone forms oil of bitter almonds, hydrocyanic and nitrobenzoic acids; with chromic acid it gives hydruret of benzoil, benzoic acid, and resin; with concentrated sulphuric acid it yields cinnamic acid and a brown substance, soluble in water and insoluble in aqueous saline solutions.—*L'Institut*, Juin 6, 1849.

OBSERVATIONS ON STYRACINE.

By F. TOEL.

Liquid storax obtained from the bark of Styrax officinalis contains, as is well known, a neutral crystalline substance, styracine, the peculiar nature of which has hitherto remained unexplained. From the author's researches it follows that the composition of the substance is expressed by the formula $C_{60}H_{28}\,O_6$, and that it is a combination of cinnamic acid having a perfectly analogous constitution to the natural fats.

By the action of a hot concentrated solution of the hydrate of potash it is resolved into cinnamic acid and a new substance, for which the name styrone is proposed. The liquid product previously obtained by this mode of decomposition, and described under the name of styracone, was a mixture resulting from the employment of impure styracine.

Styrone, $C_{42}\,H_{23}\,O_5$, distils over with the water, whilst a solution of cinnamate of potash is left in the retort. No other product is formed in this operation. The distillate is turbid, but in a short time becomes transparent and filled with a bulky tissue of small acicular crystals of styrone. It forms thin silky needles, has a very agreeable odour resembling hyacinths, melts at 91°, is volatilized without decomposition at a higher temperature, and again solidifies on cooling into a crystalline mass. It is tolerably soluble in water, and most readily so in alcohol, ether, and styrole. It is well characterized by its peculiar mode of crystallization from water. When a hot saturated solution is set aside to cool it becomes milky, and only begins to clear after some hours, becoming filled with minute acicular crystals. When observed under the microscope while still turbid, this milkiness is seen to result from innumerable drops of oil, which gradually, and frequently quite suddenly, seem to disappear and to dissolve; and in their place, all at once, a crystal makes its appearance, which grows perceptibly by attracting and absorbing the surrounding drops of oil. It is scarcely to be doubted that this phenomenon consists in a transition from the liquid amorphous into the crystalline state. The oily styrone might, however, also be a loose combination with water, and the phenomenon consist in a separation of this water.

When styrone is treated with manganese and sulphuric acid it affords oil of bitter almonds, like styracine.

If the composition of styrone found in three accordant analyses is examined more closely, and compared with that of styracine, which has likewise been ascertained with certainty by the author, together with the circumstance that the latter is converted by the action of alkali into cinnamic acid and styrone, no other probable mode of explaining the process offers itself than that styracine is a conjugate combination of cinnamic acid with a substance represented by the formula $C_{42}\,H_{21}\,O_3$, which on its separation from the acid assimilates the elements of 2 atoms of water, and is thus converted into styrone. This substance, which cannot be isolated, might be called oxide of styryle = $C_{42}\,H_{21}\,O_3$, in conformity with the name of oxide of lipyle, which is converted into glycerine on separation from the fatty acids. According to this view, styracine would be a combination of 1 equiv. oxide of styryle with 1 equiv. cinnamic acid.

Chlorostyracine, $C_{60}\,H_{21}\,Cl_7\,O_6$, is produced by the action of dry chlorine upon styracine. It forms a yellow, tenacious, viscid mass of an acrid taste and faint odour; it is insoluble in water, soluble in alcohol and ether, and not crystallizable.

Chlorocinnamic Acid, $HO + C_{18}\,H_6\,ClO_3$, is produced by the action of an alcoholic solution of potash upon clorostyracine, with the simultaneous production of a chlorinated oily substance and of chloride of potassium. It forms long, shining, flexible needles, has no smell, melts at 270°, sublimes, is slightly soluble in cold water, and very readily soluble in alcohol and ether. The salts it forms with the alkalis, the alkaline earths, and oxide of silver are crystalline. It is not identical with the chlorocinnamic acid described by Stenhouse.

It follows from its composition and mode of production that chlorostyracine may be regarded as a conjugate combination of 1 equiv. chlorocinnamic acid with 1 equiv. of an oxide of chlorostyryle, $C_{42}\,H_{15}\,C_6\,O_5$, which, on its separation from the former, is converted into the above-mentioned chlorinated oil, which, however, cannot contain all these 6 equivs. of chlorine, since chloride of potassium is simultaneously formed. This chlorinated oil is heavier than water and colourless; but becomes brown so quickly in the air that it could not be analyzed with any degree of confidence.—*Göttingen Berichte*, p. 54, 1849.

ON THE CONSTITUTION OF STYRACINE.

By Dr. A. STRECKER.

The interesting investigation of M. Toel has made us acquainted with a body which is well suited to excite our interest in a high degree. A certain analogy in the constitution of styracine with the natural fats is clearly proved, and merits our attention the more as no acid corresponding to cinnamic acid has hitherto been detected in nature in such conjugate union; nor, with the exception of the alcohols belonging to the series $C^{2n} H^2 (^{n+1}) O^2$, which correspond to the acids $C^{2n} H^{2n} O^4$, was even the occurrence of glycerine in analogous combinations known. The conjugate glycerine compounds of the fatty acids which occur in nature appear, however, to differ, as was already pointed out by Gerhardt, from the conjugate alcoholic compounds, as well as from the artificially-prepared glycerine compounds, in their being decomposed, with the absorption of six equivs. water, into 2 equivs. acid and 1 equiv. glycerine ($C^6 H^8 O^6$), although this cannot be considered as firmly established, from the difficulties which occur in obtaining these compounds pure, and which is increased by their generally high atomic weights. They would differ from the neutral ethers in the latter furnishing on decomposition only 1 equiv. acid to 1 equiv. alcohol, with assimilation of 2 equivs. water. The artificial glycerine compounds, which all correspond to the acid ethers, furnish like these 2 equivs. acid and 1 equiv. glycerine, with assimilation of 2 equivs. water.

Considered from this point of view, styracine, although approaching closely to the fats, appears to stand in a more intimate relation with the conjugate alcoholic compounds, among which must be included spermacetti and, according to Brodie's investigation, one constituent of wax.

In fact, the formula of styrone advanced by M. Toel has not been further checked by a determination of its atomic weight; and we may, therefore advance for this body other formulæ, which likewise agree with the composition found. Now, I believe to have succeeded in finding a formula for styrone, which has the property, in common with that of M. Toel, of accounting for the composition of the compounds, but deserves the preference from its greater simplicity. I assign to styrone the formula $C^{18} H^{10} O^2$, which requires in 100 parts :—

	Calculated.	Found.	Toel.	
Carbon	80.62	79.8	80.2	80.6
Hydrogen	7.45	7.6	7.7	7.6
Oxygen	11.93	12.6	12.2	11.8

The analyses agree as to the amount of hydrogen better with my formula than with M. Toel's.

According to this the composition of styracine becomes—

1 equiv. cinnamic acid	$C^{18} H^8 O^4$
1 equiv. styrone.....	$C^{18} H^{10} O^2$
	$C^{36} H^{18} O^6$
—2 equivs. water	$H^2 O^2$
1 equiv. styracine	$C^{36} H^{16} O^4$

and the per-centage composition—

	Calculated.	Found.	Toel.	
Carb...	81.85	82.56	82.57	82 61	82.15
Hyd....	6.02	6.12	6.49	6.36	6.16
Oxy...	12.13	11.32	10.94	11.03	11.69

The amount of carbon found is considerably higher than the calculated quantity; but it is well known that this is not impossible in combustions in oxygen gas; on the other hand, the loss in hydrogen, according to the other formula, is avoided by the present one.

The formula of chlorostyracine becomes $C^{36} H^{42} Cl^4 O^4$, and its composition—

	Calculated.	Found.	
Carbon	53.79	53.64	
Hydrogen	3.00		
Chlorine	35.27	35.40	35.60
Oxygen	7.94		

Styrone might, perhaps, be regarded as the hydrate of an oxide ($C^{18} H^9$), and its constitution would then be represented by $(C^{18} H^9) O + HO$.

Laying aside all theoretical considerations which may be entertained respecting the alcohols, styrone stands, according to the above formula, in a similar relation to cinnamic acid as vinous alcohol to acetic acid, ethal to cetic acid (ethalic acid), &c.; or, to express it in a few words, styrone is the alcohol of cinnamic acid. Styrone $= C^{18} H^{10} O^2 - H^2 + O^2 = C^{18} H^8 O^4 =$ cinnamic acid. As is seen, styrone contains 2 equivs. hydrogen more and 2 equivs. oxygen less than cinnamic acid, precisely as is the case with all the other known alcohols.—*Liebig's Annalen*, and *Chemical Gazette.**

PROCESS FOR OBTAINING COPIES OF MEDALS, AND OTHER SIMILAR OBJECTS, ON METALLIC COPPER, BY PRESSURE.

By M. G. OSANN.

An observation which the author accidentally made in the year 1830, relative to copper reduced by hydrogen, during his investigations concerning the atomic weight of metals, &c., led him to the discovery of this art. He had remarked that oxide of copper reduced by hydrogen gives an extremely fine powder, easily compressible, which, submitted to the action of heat, agglomerates and gradually unites, acquiring the solidity of melted copper. In repeating Jacobi's galvanoplastic process, he found that in using a simple battery six or seven days were necessary for obtaining copper impressions of the thickness of a line. His former observations recurred to his mind, and he tried to produce these impressions by compression. The following are some details concerning this process :—

1. A solution of sulphate of copper is made; it is boiled for half an hour, to peroxidize the iron which it contains; it is then filtered, boiled again, and precipitated while warm by carbonate of soda gently poured into it. It is allowed to settle, then washed by decantation, filtered through double paper, and slowly dried on blotting paper; it is afterwards strained through gauze, in order to obtain the finest powder.

2. The carbonate thus produced is placed in a long glass tube, and reduced by hydrogen, purified first with a little acetate of lead, then with potassa. The tube is heated by means of a lamp occasionally passed under it, as it is essential that the powder obtained should be very fine; and, to ensure this, the reduction must be made at a very gentle heat. During the reduction there is very soon observed a pungent odour of sulphurous acid, which arises from a small portion of sulphate of copper obstinately remaining mixed with the carbonate. This gas, and the water which is disengaged, being at the furthest end of the tube, interfere with the reduction; the first portion of the powder is, therefore, withdrawn with a small iron hook, for the purpose of being subsequently treated again. The fine powder ultimately obtained should present the aggregation of spongy platinum, and its colour should be light copper red. This powder is very oxidizable in the air: it must, therefore, be immediately confined in a well-closed vessel, and it is as well to use it the same day for taking impressions.

3. The powder must now be compressed on the medal. For this purpose a tube of white iron of the diameter of the medal, and about four inches in length, is employed; it is enveloped in paper. Powdered brick is first put in, then the medal is laid on, and on that a layer of very finely-sifted copper, then the coarser powder, to the height of about ten or twelve lines. Then gently press with a massive cylinder of iron; put the whole on an anvil, and strike it with a hammer until the powder becomes no further compressed. The whole is driven out of the tube by striking without supporting it; the copper has now become coherent and solid, and is easily separated from the medal. Instead of the hammer, a lever-press may be used.

4. The copies obtained must finally be heated to redness, to complete the agglomeration. To prevent the access of air, a copper box, furnished with a lid, is made; two copies are placed in it, and separated from one another by means of three small pieces of copper leaf. The box is luted with clay, and heated to an incipient red-whiteness; it is left to cool, and the impression is finished, solid, of a fine copper red, a little bronzed here and there where the compression has been strongest.

SOME INTERESTING FACTS RESULTING FROM THESE INVESTIGATIONS.

(*a*) Copper reduced by hydrogen gas is powerfully electrical. If we support on it a plate of brass furnished with a glass handle (the plate of a condenser, for example), this plate is so strongly electrized that even at a considerable distance it acts on the gold leaf of an electrometer. This fact appears to be of considerable importance in theoretical chemistry. Osann considers it as one of the principal arguments in favour of the opinion which regards electricity and chemical affinity as one and the same force. In this state the copper is oxidizable in the highest degree, and at the same time highly electrical. May it not be supposed from this double circumstance that it is electricity which determines the combination of the copper with oxygen?

(*b*) If a small quantity of copper reduced to hydrogen be thrown into gaseous chlorine, it becomes inflamed in it at the ordinary temperature, and burns with a white flame. This experiment is curious, and easily repeated in chemical lectures; it is important, also, for demonstrating the influence of mass and cohesion on chemical affinity.

(*c*) Another curious phenomenon is the considerable contraction which the copper impressions undergo when heated to redness. The maximum of this contraction, estimated approximatively, may amount to one fiftieth of the diameter of the coin from which the impression has been taken. The design does not experience the slightest alteration, except that its dimensions are somewhat reduced.

(*d*) Copper thus agglomerated is harder than that which has been melted. This is perceptible to the touch, but still more so to the file. It is, doubtless, a very interesting fact, that copper, in the state of agglomeration—that is to say, when its particles are farther apart than when it has been melted—is harder and apparently more solid.

EXPERIMENTS FOR OBTAINING SIMILAR IMPRESSIONS WITH OTHER METALS.

As yet the author has experimented with only two metals, silver and lead. He prepared the silver by precipitating a solution of the nitrate by copper. After being washed and dried, it was placed on the coin, and thus submitted to the action of the lever-press. The copy had the colour of unpolished silver. It was then heated to redness in the copper capsule above described, which operation caused it to undergo some slight contraction, without any other alteration. The metal became solid and compact, and had a fine lustre. The lead was precipitated by zinc from a solution of acetate of lead. The adhering water was removed with blotting paper, after which it was compressed on a piece of money. The impression easily separated from the metal; it presented an exact copy of it, but had a dull lead colour, which was not advantageous.

ADVANTAGES OF THIS PROCESS OVER THAT IN WHICH THE HYDRO-ELECTRIC CURRENT IS USED, AND ITS PRACTICAL APPLICATION.

The following are the principal advantages in question :—

(*a*) When once the copper powder is prepared, there is not the least difficulty in taking impressions of any thickness, and superior in hardness to those taken with copper in fusion.

(*b*) Any body whatever, whether a conductor or non-conductor of electricity, may be reproduced by these impressions of copper. Hence

* Vide the preceding article.

this process becomes capable of general employment, and may even be extended to organic bodies. The author tried to copy in copper lithographic drawings on stone. In the same way might be taken copies of engravings on copper by aquafortis, and even larger objects, such as statues. These impressions might afterwards serve as moulds for copies in relief on copper.

(*c*) The copies are of exceeding clearness, surpassing even that of the original. This is owing to the contraction which they undergo when heated to redness, and which causes the design to be reduced to smaller dimensions. As these impressions may in their turn serve as moulds for new copies in relief, it may be conceived that, by aid of their property of contracting by heat, we may obtain from one medal copies as small as can be desired.

(*d*) With this process may be obtained true copies of medals with two faces in relief. With this view, two hollow copies are taken; a layer of copper powder is put between them, and they are strongly pressed against one another. The copy obtained is hardened in the fire, which reproduces, with clearness, the medal on a rather smaller scale.

The following are some of the applications of this process pointed out by the author:—

1. The hollow copies being very well reproduced in sealing-wax, we may make of copper the required number of impressions of an engraving in relief of metal, and these impressions may serve as seals. Bodkins (poinçons) may thus be reproduced in a very simple manner, and at very little cost.

2. This process may be applied to type-founding. For this purpose it would be sufficient to sift the reduced metallic powder into the matrix. The characters obtained would be rather smaller than the matrices, but clearer than those which are cast.

3. It may be employed for making metallic mirrors. For this the reduced copper must be spread on a polished glass, concave or convex. The mass thus obtained is submitted to the action of fire in the copper box, and is silvered on the internal or external surface, according as a convergent or divergent mirror is desired.

4. Copper reduced by hydrogen and compressed, contracting in so uniform a manner by the action of heat, might serve with advantage for pyrometric measures. It would fulfil the same part as the clay cylinders in Wedgewood's pyrometer.

The medals, of which copies have been made in copper, not being injured by this operation, it would be, to any one having at his disposal a cabinet of medals, a most favourable means of making very accurate copies of rare medals. Besides their great clearness, they would have the advantage over plaster of Paris of not being brittle. There might also be procured exact and durable copies of many other works of art.

ON A PHOSPHATOMETRIC PROCESS FOR THE PURPOSE OF ASCERTAINING THE QUALITY OF MANURES, AND MORE PARTICULARLY THE BLACK RESIDUUM OF REFINERIES.

By MM. ED. MORIDE and AD. ROBIERRE.

In the course of the experiments which we made upon the residuum of refineries, we employed, in order to ascertain the quantity of phosphate of lime in animal charcoal, a process to which we think proper to call the attention of agriculturists and persons desirous of analyzing manures.

Combined with the simple means given by M. Peligot for ascertaining the quantity of nitrogen contained in any substance, the phosphatometric method which we employ allows of the principal elements of manures being readily discovered. We will now briefly describe this method, taking for example the analysis of the black residuum of a refinery:—

It is to be dried at a temperature of 212° F., and a certain quantity (say one grm.) weighed off and incinerated in a platinum crucible. To the red ash a small quantity of carbonate of ammonia is to be added, in order to carbonate the lime which has been rendered caustic by the calcination, and the residuum is weighed. The difference in weight indicates the carbon and the organic matter. The ash obtained is thrown upon a filter, and washed with boiling water; the soluble salts are thus removed by the water.

When the water of filtration no longer yields a precipitate in the presence of chloride of barium, the filter, with the washed ash which it contains, are calcined in a platinum crucible; the residuum is then weighed, deducting the weight of the filtered ash, which should be previously ascertained. The difference in weight of the ash, before and after washing, gives the quantity of soluble salts in the water. This quantity rarely exceeds from one to two per cent. of the residuum.

The ash is introduced into a close tube, and dissolved at a low heat in the smallest possible quantity of pure nitric acid. When the solution is completed, the whole is poured into a glass vessel, care being taken to carefully remove the slightest traces of liquid which may be contained in the closed tube.

The liquid thus obtained contains phosphate and (carbonate of) lime, alumina, oxide of iron, and magnesia; it also holds in suspension silica, which might be estimated by simple filtration, but which is not taken any notice of when the object is only to ascertain the quantity of phosphate contained in the substance submitted to analysis. The liquid is now very carefully saturated with pure ammonia, which is poured in drop by drop, stirring at the same time with a glass rod. Each drop of ammonia, as it falls into the solution, produces a precipitate of phosphate of lime, which is rapidly dissolved by agitation; but after a certain time it becomes insoluble; no more ammonia must then be supplied. It is very important that the precipitate should cause but slight cloudiness, and, with a little practice, the moment of transition may be readily ascertained; the liquid is at that time slightly acid. A few drops of acetic acid are added, in order to redissolve, as quickly as possible, the phosphate held in suspension.

We have remarked that the liquid generally remains turbid, especially if the nitric solution of the phosphate of lime is prepared at too great a heat. The operator should, therefore, pay great attention to this point.

The process which has been found the most simple, and at the same time the most correct and expeditious, for arriving at the quantity of phosphate of lime, consists in the employment of a normal solution of acetate of lead, which is poured into the dissolved phosphate until iodide of potassium indicates an excess of oxide of lead in the mixture, which has been carefully alcoholized.

For the composition of our normal liquor we took for basis the composition of the phosphate of lead, obtained as above described. We ascertained that this phosphate was a mixture of sesquiphosphate and a small quantity of biphosphate of lead. Its composition was as follows:—

Phosphoric acid	20 parts.
Oxide of lead	80 "
	100

We have, therefore, based our calculations upon quantities which experience has shown to be constant, and we have estimated the quantity of pure acetate of lead necessary for representing 80 of oxide of lead. This quantity is equal to 136.26. Now, 100 parts of phosphate of lead obtained by us represent by their phosphoric acid 43.85 of phosphate of lime from bones, adopting for this latter body the formula PhO_5, 3CaO, admitted by M. Raewsky; consequently 310.74 will represent the quantity of pure crystallized acetate of lead necessary for saturating the acid in 100 parts of phosphate of lime, or 3.107 grms. for one gramme; the 3.107 grms. dissolved in the water will constitute 50 cubic centimetres of normal liquid. A litre (about a quart) of liquid ought, therefore, to contain 62.14 grms. of acetate of lead. Care must be taken to acidify this liquid with a little acetic acid.

50 cubic centimetres of normal liquid, introduced into an alkali-metric vessel, will saturate 1 grm. of phosphate of lime from bones; that is to say, the vessel being graduated into 100 parts, each degree will represent 1 centigramme of phosphate.

The operator, having filled the graduated vessel, takes a thin plate of glass, on the surface of which he deposits, with a glass rod, ten drops of iodide of potassium. He then pours the normal solution of lead into the solution of phosphate, saturated with ammonia as above stated, stirring it briskly after each fresh addition; phosphate of lead is immediately produced, and precipitated with remarkable rapidity.

If, at this moment, the end of a glass rod be moistened at the surface of the mixture, so as not to touch the phosphate which is deposited, but merely the supernatant liquor, and if the drop thus obtained be brought into contact with one of the iodized drops deposited upon the glass plate, the reaction produced will easily show whether there is or is not an excess of oxide of lead in the liquor. It will, in fact, be understood that as long as there is any phosphate to decompose the oxide of lead of the acetate will be converted into phosphate of lead.

At a certain moment (and this is a fact both curious and useful) the iodide of potassium causes the liquid to assume a yellow colour, at a time, too, when it might be supposed that the proper proportions had been used; but this is not the case. At this moment, the phosphate being almost entirely decomposed, the acid in excess in the liquor exercises a feeble reaction upon the phosphate of lead, and determines its solubility. This tendency to dissolve is, however, very weak, but sufficient to communicate to iodide of potassium a yellow colour, which serves as a test.

This test gives a tolerably correct notion of the richness of the substance in phosphate of lime; for, as we shall presently see, this previous yellow colouring produced upon the plate of glass takes place very little before the completion of the operation.

To the liquid two thirds of its volume of alcohol are added, in order to neutralize the slight degree of solvent power possessed by the excess of acid; and from this moment the plumbic solution is to be carefully poured in, care being taken to stir with a glass rod, and to allow of phosphate of lead depositing, before touching the surface of the mixture with the rod. As soon as the drop acquires a greenish-yellow colour by contact with the iodide of potassium the operation must be stopped; the amount of phosphate contained in the manure may then be ascertained by observing the degree marked on the graduated glass.

When the acetate of lead employed is not perfectly pure, it will be necessary to make a previous experiment by dissolving a known quantity of phosphate of lime; and the result of all subsequent experiments may be ascertained by a simple calculation of proportion.

This phosphatometric operation requires but a few minutes for its execution, and furnishes results the correctness of which it is very difficult otherwise to arrive at when phosphates mixed with alumina are to be operated upon. It may be briefly described as consisting of the following operations:—

1. Solution in nitric acid of the matter deprived of its soluble salts by water.

2. Saturation with ammonia until the appearance of a slight precipitate, which is redissolved in a few drops of acetic acid.

3. Saturation of the phosphoric acid by means of the normal solution of acetate of lead.

4. Addition of a quantity of alcohol equal to two thirds of the whole volume, as soon as a drop obtained from the surface of the liquid causes iodide of potassium (placed upon glass) to assume a yellow colour.

5. Observation of the moment when an excess of lead salt appears in the liquid mixed with alcohol.

If, as stated by M. Dumas, there is any utility in ascertaining the quantity of phosphates in manures, we think we have much simplified the means of arriving at a desirable result.—*Technologiste*, and *Newton's Journal.*

THE GEOLOGY OF THE ISLE OF WIGHT.

By GIDEON MANTELL, LL.D., F.R.S.

Geology may be termed the physical history of our globe,—it investigates the structure of the planet on which we live, and explains the characters and causes of the various changes in the organic and inorganic kingdoms of nature. It relates to the history of the past, and carries us back, by the careful examination of the relics of former ages, to periods so remote as to startle all our preconceived opinions of the age of our globe. At the first step we take in a geological inquiry we are struck with the immense periods of time which the phenomena presented to our view must have required for their production, and the incessant change which appears to have been going on in the natural world; but we must remember that time and change are great only with reference to the faculties of the being which notes them with the enlargement of his mental powers. Man takes now a more just and comprehensive view of the great scheme of creation; and while *formerly*, in his ignorance, he imagined that the duration of the globe was to be measured by his own brief space, and arrogantly deemed himself alone the object of the Almighty's care, and that all things were created for his pleasure or necessities, he *now* feels his own dependence, entertains more correct ideas of the mercy, wisdom, and goodness of the Creator, and learns the most important of all lessons, viz., to doubt the impressions of his senses until confirmed by cautious and patient investigation.

The order of time in which the various rocks forming the crust of the earth originated are as follows:—Granite in shapeless masses and veins, as porphyry, serpentine, trap, &c. The gneiss system, formed of gneiss, sienite, and quartz, alternating with clay, slate, mica, schist, &c.; mica schist—sedimentary rocks altered by high temperature — mica, slate, quartz rock, &c. These rocks exhibit no trace of organic remains. Next came those of the graywacke system, consisting of slate rocks with shells and corals. The silurian system, composed of marine limestone, shells, sandstones, calcareous flags. Those abound with shell, many of new forms, and swarm with trilobites, corals, and crinoidea. The coal system, comprising shells, ironstone, millstone, grit, freshwater limestone, and immense beds of coal. In the lower part of this series are red sandstone and conglomerates. This system is characterized by innumerable remains of land and aquatic animals, of numberless species and genera, and of tropical character; fishes, reptiles, insects. The saliferous system comprises marls, sandstones, and conglomerates, often of a red colour in the shells, corals and plants, fishes and reptiles. This series forms the grand depository of the rock salt. The lias is made up of a series of clays, shales, and limestones, with marine shells, cephalipoda, omnidon, and fishes. This formation includes many reptiles of extinct genera, particularly the plesiosaurus and ichthiosaurus, in immense quantities. The oolite is a marine formation of vast extent, consisting of limestone and clay, abounding in marine shells, corals, fishes, and reptiles, both terrestrial and marine. The wealden formation comprises the weald clay, the strata of Tilgate forest, and the limestone and clay of Purbeck. It is a freshwater formation, and evidently the delta of some ancient river. It is characterized by an abundance of the remains of enormous and peculiar reptiles, the inguanodon, hylæosaurus, megalosaurus, crocodile, &c.; of terrestrial plants, freshwater mollusca, and birds. The cretaceous system is a marine formation, and comprises beds of marl, limestone, sandstone, and clay; it abounds in remains of zoophytes, mollusca, echnodermata, fishes, &c.; drifted wood and marine plants, crocodiles, turtles, and extinct reptiles. The tertiary strata consist of an extensive series, comprising groups of marine and mollusca deposits, characterized by the remains of animals and vegetables, the greater portion of which are extinct. The modern and ancient alluvial strata are composed of the deposits of rivers, lakes, &c. The modern alluvial strata are characterized by the remains of man and contemporaneous animals and plants; the ancient by an increased proportion of large mammalia and carnivora, of species and genera both recent and extinct.

The Isle of Wight, although now separated from the main land, is a disrupted mass of the formations of the south-east of England. The deposits of this district constitute three principal groups. The first consists of the tertiary beds of gravel, sand, and clay, which occupy depressions in the chalk. The second is the chalk, which forms the most striking feature in the physical geography of the country constituting the South Downs, which, from the bold promontory of Beechy-head, traverse the whole county of Sussex from east to west; and pass by Hampshire into Surrey. From Godalming the chalk extends by Godstone into Kent, where the range is called the North Downs, and terminates in the cliffs of Dover. The third group is spread over the area between the North and South Downs; the most elevated masses forming a range called Forest-ridge, which traverses the district from east to west, and is composed of alternations of sandstone, sand, shales, and clay, with a deep valley on each flank called the Weald. From the centre ridge of the Wealden the stratum diverges on each side towards the downs, forming an anticlinal axis, and finally disappears beneath the lowermost bed of the chalk.

The chalk basin of the south of England has at some period, which it would be premature to assign very particularly, been lifted up by some elevatory movements and convulsions of great intensity. At this period, the channel which separates France from England was broken through, and the transverse valleys of the north and south were produced and enlarged; for, although these valleys are now river-courses, yet it is obvious they originated in disruption, for the stratum in every instance diverges from the line of fracture. These movements materially changed the physical geography of the south of England, and the contiguous parts of the Continent; and occasioned a vertical position of the strata in the Isle of Wight and Hampshire. In these there is an extensive suit of tertiary strata, which, like those of France, are made of limestone, clay, and sand, containing marine remains, with intercalations of freshwater remains. This series of freshwater beds extends over a considerable district. On the east a small outline of the lower beds appear at Castle-hill, near Newhaven, but proceeding to the westward of Brighton. The London clay rises to the surface beyond Worthing, and forms the tract between the Downs and the seashore.

A remarkable instance of the disruption above alluded to occurs at Alum Bay, in the Isle of Wight. This bay takes its name from the alum formerly extracted from the pyrites with which the clay abounds. The clay and sand in this bay exhibit the actual state of the stratum immediately above the chalk, before any change took place in the position of the latter. For although the beds of which they are composed are quite vertical, yet, from the nature and variety of their composition and the regularity and number of their alternations, no one who views them but must see that they have suffered no change, except that of having been moved from a horizontal to a vertical position. The colour of these sands and clay embraces every variety of green, yellow, red, crimson, ferruginous, white, black, and brown. Beds of pipeclay also occur; some of these contain layers of wood-coal, with branches and leaves of vegetables. This coal burns with difficulty, and emits a sulphurous smell; masses are constantly drifted by the sea, and thrown on the seashore near Brighton, where this substance was formerly used as fuel by the inhabitants. The London clay extends over the greater part of the area of the Hampshire basin. Castle-hill, near Newhaven, is a series of sands, marls, and clays, with beds of oyster-shells and shingles, that occupy the upper part of the hill, and rest upon the chalk which forms the lower part of the cliff. The subsulphate of alumina, a mineral substance peculiar to this locality, occurs in the ochraceous clay which lies next the chalk. Selenite abounds in the gypseous marls; a layer of wood-coal, a few inches thick, contains impressions of plants. The argillaceous beds contain marine shells in such abundance that some of them are mere masses of compressed shells, held together by argillaceous earth. The oysters are consolidated into coarse stone, and, when pebbles enter into the composition of this concrete, a close resemblance is presented to the oyster-breccia. Teeth of sharks, and a few freshwater shells, have been collected in these strata. Proceeding westward from London, the London clay is perceived near Worthing, emerging from beneath newer deposits. At Bognor an arenaceous limestone, full of the usual shells, of the *calcaire grossier*, and London clay, constitutes a group of lime rocks; which in another direction will have totally disappeared. In the blue clay at Bracklesham Bay fossil shells may be obtained at low water in profusion; and Hordwell Cliff has so long been celebrated for similar productions that its elegant shells are seen in every collection of organic remains. In all these localities the shells are of the same genera and species with those of the contemporaneous deposits in France. The great peculiarity and interest of the Isle of Wight basin, as compared with that of London, consists in the existence of strata containing almost exclusively freshwater shells; and affording in a few instances remains of the animals that occur in the vicinity of Paris.

Mr. Webster has arranged the various tertiary beds of Hampshire as follows:—First. Lowermost, plastic clay, and sand. Second. London clay. Third. Freshwater deposits, sandy calcareous marls, with immense quantities of freshwater shells. Fourth. Clay and marl, abounding in marine shells, very generally of different species from those of London clay. Fifth. Upper freshwater deposits; yellowish white marl and calcareous limestone, employed for building, nearly sixty feet thickness, and almost one entire mass of shells. The above series is well developed at Headon-hill, where the freshwater strata which succeed the marine beds of Alum Bay lie in a nearly horizontal direction. At Binstead, near Calbourne and Morley, quarries have been opened in the freshwater limestone, and bones of anoplotheria and of a species of moschus have been discovered. At Sandover Bay, in the Isle of Wight, clay identical with the weald clay, and containing Sussex marble, may be seen within a few hundred yards of the chalk, and extending to the Red Cliff; and also at the junction at the east of Freshwater Bay, where the clay abounds in the minute shields of Cyprides.

At Brook Point the cliffs, which are about thirty feet high, are formed of clay, with inferior beds of soft sandstone, and contain lignite and various vegetable remains, strongly impregnated with pyrites. Trunks of trees of a coaly blackness are seen imbedded in the clay of the cliff, and scattered along the shore. In many of the stems the ligneous structure is beautifully preserved, and veined with pyrites—other portions resemble jet. The strand at low water is seen to be formed of these fossils, and, upon removing the seaweeds that grow upon the shore, the petrified trees occur imbedded in masses of clay which have become indurated.

THE CHEMICAL TIMES.

SATURDAY, JULY 21, 1849.

THE VENTILATION OF SEWERS.

In our last number we erroneously attributed to the metropolitan commissioners of sewers the recent introduction of gratings as a means of effecting the ventilation of the sewers. We have since been informed that the system of ventilating the sewers through openings made in them has been in operation in the City for some considerable time, and the City commissioners and their surveyor, Mr. Heywood, pride themselves not a little on the adoption of this system (bad though it is, even by *them*, admitted to be) by their metropolitan brethren. It must be observed, however, in justice to those who first introduced this most pernicious system of ventilation, that, at the time of its introduction in the City, cesspools which were emptied by nightmen were the order of the day, and that one of the principal objects in view was the abolition of these cesspools, or the discharge of their contents into the sewer. Unfortunately the *remedy* was much worse than the *evil* which it was intended to correct, and the result of its application was speedily discovered to aggravate tenfold the original nuisance. Notwithstanding the perfect notoriety of this fact, the sapient metropolitan commissioners thought they could not do better than imitate their City colleagues. The result has, of course, been the same in the sewerage of the metropolis it had previously been found to be in that of the City. But, notwithstanding, no attempts have been made as yet either by the metropolitan or the City commissioners to remedy so glaring and dangerous an evil—the more dangerous at the present moment when reasonable apprehensions may be entertained that the *true* Asiatic cholera is, indeed, on the point of commencing its ravages in downright earnest; which ravages, let the amiable gentry of the sewers, the Board of Health, and the Woods and Forests rest fully assured, will not be confined to the wretched denizens of the courts and alleys of the east and south, but will carry death and desolation into Belgravia, and the other most fashionable quarters of the West. The report, which appears in the *Times* of the 19th inst., of the state of the sewers in these quarters is discouraging indeed, and fully shows how miserable must have been the management that could produce such disagreeable results.

In our last number we confined our strictures to the metropolitan commission. From the omission of all mention of the City commissioners, our readers might, perhaps, infer that no just fault is to be found with the way and manner in which the latter perform the duties assigned to their body. Such an opinion would be very erroneous indeed, as the following simple statement of one fact out of many similar ones will amply show.

Mr. Coxworthy, it appears, having failed in obtaining a hearing from the M. C. of S., called on a few of his friends in the City who suffer most injuriously from the stinkholes made in the sewers; and, having offered to explain to the City commissioners his own plans of ventilation, if he were armed with a memorial as an introduction to the board, was soon in possession of the following document, signed by about forty or fifty booksellers, silkmercers, hat-manufacturers, chemists, and other most respectable tradesmen and inhabitants of the City, residing in Paternoster-row, Fleet-street, Ludgate-hill, *and the neighbourhood of Printing-house-square*, amongst which latter may be mentioned the gentlemen at Apothecaries'-hall, who most loudly denounced the nuisance of the gratings:—

"TO THE COMMISSIONERS OF SEWERS FOR THE CITY OF LONDON.

"We, the undersigned inhabitants of the city of London, more immediately affected by the pernicious gases escaping from the sewers through the gratings put down for their ventilation, being apprehensive of the most calamitous results to the health of the population if those gratings be allowed to remain, especially if the metropolis be visited by the cholera or any other epidemic, do most earnestly request you will immediately cause them to be removed, and adopt such plans for the proper ventilation of the sewers as may seem to you best calculated to effect that object, without creating the greater evil of contaminating the atmosphere of the streets and greater pollution of the river Thames."

(Signed by about fifty inhabitants of Ludgate-hill, Fleet-street, Paternoster-row, Bread-street, and the immediate neighbourhood of Printing-house-square, including Apothecaries'-hall.)

This document Mr. Coxworthy forwarded to the commissioners, with a memorial of his own, conceived in the following terms:—

"TO THE COMMISSIONERS OF SEWERS FOR THE CITY OF LONDON.

"The memorial of Mr. Franklin Coxworthy. Showeth,—

"That the recent sanitary regulations, by which all cesspools near buildings are very properly abolished, enforce the passage into the sewers of all nightsoil and other offensive matter formerly excluded from them; the noxious gases formed by the putrefaction of this matter have, therefore, so much increased in volume as to demand some improved system for the ventilation of sewers, as is testified by the gentlemen whose names appear in the enclosed requisition, and who reside in the immediate neighbourhood of a few of the sewer ventilators within the jurisdiction of the City.

"That, for the evil complained of, memorialist is prepared to offer an efficient and simple remedy, in explanation of which, together with other points of importance connected with sewerage, he craves to be granted a hearing.

"FRANKLIN COXWORTHY,
"Author of 'Electrical Condition,' &c.
"Westminster-road, Oct. 2, 1848."

Two days after he received the following letter from the principal clerk of the commission:—

"Sewers-office, Guildhall,
October 4, 1848.

"Sir,—I have to acknowledge your letter and memorial of the 2d inst., which were laid before the Court of Sewers of the city of London yesterday, but were not read, on account of your absence.

"The court will again meet on Tuesday next, at eleven o'clock precisely.

"I am, sir, &c.,
(Signed) "JOSEPH DAW, Pl. Ck.
"Mr. F. Coxworthy."

Mr. Coxworthy then wrote to Mr. Daw, and informed him that he should attend the court on the following Tuesday, for the purpose of explaining his plans to the commissioners. He did attend on the appointed day, and, much to his gratification, met in the court no less than five gentlemen connected with the press.

Not hearing his name called, Mr. Coxworthy inquired of a friend in court what had become of his papers, when he was informed that he had not been called *because he had not sent his name up to the chairman.* Upon this Mr. Coxworthy explained to his friend that he had written to the secretary informing him of his intention to attend. It was ultimately discovered, however, that Mr. Coxworthy's papers and others had been *lumped*, and referred to the special committee, which simply meant that they had been shelved. And thus was consigned to oblivion a memorial from about fifty respectable inhabitants of the City, complaining of an intolerable nuisance which daily undermines their constitution, and which, as is affirmed by Dr. Barlow and other eminent medical gentlemen, places the body in a condition most favourable to the reception of epidemic and other diseases.

Now, it happens that the very localities from which the memorial in question proceeded, and which are now even in a worse state than they were at the time of its presentation,* are at present among the principal seats of the cholera; and we feel almost inclined to ask whether the death of many of the victims of that scourge in this and other parts of the City may not be said to be distinctly referable to the system of gratings so pertinaciously adhered to by the commissioners?

As we remarked in our last, this question is of too vital importance to be permitted to rest. We deem it our imperative duty to call upon the inhabitants of the City, as we did in our last on those of the Borough, to get up a requisition to the Lord Mayor for the immediate convening of a public meeting on the subject Let those who seem so particularly anxious to shelve the question bear in mind the well-known aphorism, "Truth courts inquiry and discussion; error shuns them."

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* At the last sitting of the City Court of Sewers a gentleman attended on behalf of the proprietors of the *Times*, to call the attention of the commissioners to the dreadful effluvia from the sewers about Printing-house-square. He stated that it became at times absolutely necessary for the persons employed in the establishment to leave the premises.

The improved disc engine lately fitted up and used in driving the *Times* printing-machines occupies a singularly small space—seven feet long and four feet wide; and the highest part of the engine is only three feet above the floor of the room. The peculiarity of this engine is that it gives direct motion to a crank on the engine-shaft, and exerts a perfectly uniform force on it throughout the revolution; and when driven by gearing without a flywheel there is no "back lash" in the wheels; the steam can be cut off at a very early part of the stroke without materially affecting the regularity of the driving force; and, although the speed of the piston (*i.e.*, of the disc rings) is only 200 feet per minute, the engine makes three times as many revolutions per minute as the common engine. A contemporary deems it admirably adapted for driving the screw-propeller direct, as the engine-shaft has only to be extended through the vessel, and have the propeller attached to it; it would thus enable vessels which cannot spare much room to adopt the screw-propeller.

STATEMENT IN CONTINUATION OF THE ONE PUBLISHED IN THE CHEMICAL TIMES OF JULY 14, 1849, SHOWING THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE AIR FROM JULY 8 TO 14 INCLUSIVE, AS INDICATED BY THE EVAPORATION OF WATER FROM TWO COPPER VESSELS OR SCALES, ONE INSULATED AND THE OTHER NOT. ALSO THE READING OF THE BAROMETER, THERMOMETER, DIRECTION OF WIND, AND GENERAL STATE OF THE WEATHER.

July, 1849.	Barometer.		Therm.		Scales.				Wind.		General State of Weather.
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Insulated	Non-Insulated	Morning.	Evening.	
8	30.07	30.15	73	71	20 I.	..	20	..	W.	NW.	Fine all day; large white clouds in the afternoon, which indicate rain having fallen to windward.
9	30.25	30.35	69	69	10 I.	20 N.	10	20	N.	N.	Fine all day.
10	30.40	30.38	69	68	10 I.	30 N.	10	30	NE.	SE.	Overcast morning; and evaporation sluggish till two o'clock; fine rest of day.
11	30.38	30.37	67	67	10 I.	30 N.	10	30	NE.	SE.	Fine all day.
12	30.37	30.30	67	65	..	10 N.	..	10	NE.	N.	Fine all day, but much white cloud.
13	30.25	30.22	68	66	5 N.	15 N.	..	20	E.	NE.	Fine all day, but much white cloud, *with black clouds under the white clouds.*
14	30.22	30.14	65	65	..	30 N	..	30	NE.	NE.	Fine all day, but much white cloud.

From the 1st to the 8th inclusive the wind was from the west, or in that quarter; from the 10th to the 14th it was in an opposite direction; when from the west it travelled with the earth in its revolution upon its axis; when from the east in opposition to it. Westerly winds generally induce an excess of evaporation from the insulated vessel; easterly winds from the non-insulated one; and we have always been taught that "the wind from the east is good for neither man nor beast;" but whether electrical condition influences the wind, or the wind produces the peculiar condition in the air that generally attaches to it, yet remains to be solved.

Westminster-road, July 16, 1849.

Franklin Coxworthy, Author of "Electrical Condition," &c.

MISCELLANEOUS CORRESPONDENCE.

[To the Editor of the Chemical Times.]

Sir,—I perceive that in your answer to a correspondent, respecting the terms hydrochloric and chlorhydric acid, you appear to give the preference to the former, and, if I may judge from the after recurrence of the terms muriatic and hydrochloric, you are more favourably inclined to them than to that of chlorhydric acid. You will doubtless allow that the nomenclature of a body ought to agree as nearly as possible with the most prominent characters of the body. Now, it is a rule in the nomenclature of the haloid compounds that the most negative body shall occupy the first place in the designation of such compounds. If it were not for this rule we should have nothing but confusion: one person would say chloride of iodine, sulphuret of arsenic, &c.; another, and with equal justice, would say iodide of chlorine, arseniuret of sulphur. Then, as Cl is the negative to hydrogen, why should it not have the first place in the name of the acid produced by the combination of these two bodies? If this were done, we should not have to depart from the rules laid down for the nomenclature of salts; we read that all acids ending in *ic* become *ates* when in combination with an oxide; if your hydrochloric acid did combine with an oxide, it would be all right to call the salt an hydrochlorate; but when we say the H of an acid combines with the O of the oxide to form water, and we strike hydro off, we have chloric left, which, according to all present rules, would form a chlorate with the metal: indeed the name, hydrochloric acid, conveys an idea to the mind that it is an hydrate of chloric acid. These difficulties are all removed by using the correct name (chlorhydric acid). By the same reasoning the correct names for the other hydracids now generally known as hydrofluoric, hydrobromic, and hydriodic, would be fluorhydric, bromhydric, and iodhydric. C. H.

[Our correspondent seems to have misunderstood our meaning. On an attentive perusal of our remarks on R. W. C.'s suggestions (page 50) he will find that we expressed no opinion on the greater or less propriety or correctness of either of the rival terms, but confined ourselves to the simple statement of a fact, viz., "that the term 'chlorhydric acid' is not used by English chemists, hydrochloric and muriatic being the received terms this side of the channel." Our remarks at the end of the notice were intended to apply solely to R. W. C.'s suggestions of the substitution of a perfectly novel nomenclature for the one now generally adopted by English chemists. We perfectly agree with our correspondent that it would be correct to say chlorhydric acid, fluorhydric acid, &c., instead of hydrochloric acid, hydrofluoric acid, &c.—Ed.]

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Joseph Declcy, of Newport, in the county of Monmouth, engineer, for improvements in ovens and furnaces. Patent dated December 16th, 1848. Enrolled June 16th, 1849.

This specification relates:—First. To the construction of iron smelting furnaces. Secondly. To the construction of iron melting furnaces; the object of the patentee being to dispense with the use of the blowing apparatus usually employed; by substituting for such the draught of a chimney, combined with a peculiar arrangement of air and smoke passages.

The specification is accompanied by illustrative engravings. The lower part of the furnace is provided with a tapping-hole in the usual manner. The fuel and the iron ore are introduced into the furnace through a suitable passage having an iron hopper of a peculiar construction, placed above it. This hopper is mounted upon pivots at each end, in such manner that when its mouth is upwards, and it is empty, it will remain in that position, by reason of its heaviest part being downwards, and thus closing the mouth of the charging passage. The charges of fuel or ore are placed in the hopper; when it is full, the weight of the upper part will preponderate over the lower; and the hopper will, by its gravity, turn upon the pivots until the mouth comes to that of the charging passage, when, of course, the charge will pass from the hopper through the passage to the furnace. The hopper being now empty and light, the opposite side will preponderate, and it will again turn, and resume its original position; being thus, in fact, self-acting. In front of the furnace, and passing into it, are air passages, closed, with the exception of the lowest one, by dampers or valves, so that they may be opened or shut at pleasure. At the opposite side of the furnace, and exactly opposite the air passages, are corresponding smoke and vapour passages. These passages open into an inclined curved passage leading to the chimney of the furnace. At the end where they open into the inclined curved passage they are provided with dampers or valves, capable of being opened or closed at pleasure, by means of weights and chains. By the aid of these dampers, and the dampers upon the air passages, the heat in the furnace can be regulated to the extent required; as, when a considerable degree of heat is required throughout the entire mass in the furnace, all the air passages are opened, and the lowest smoke and vapour passage closed; the reverse of this, namely, closing the air passages, and also the upper of the smoke and vapour passages, and opening only the lower passage, will produce an opposite effect.

The second improvement is the adaptation of the above mode of construction to an air furnace, for the purpose of melting pig iron, for foundry purposes. In this arrangement there is a sort of oven constructed in the furnace, between the fuel and the chimney, where the iron is submitted to a considerable heat, before it passes amongst the burning fuel. The charges are supplied to the furnace by means of a revolving hopper, similar to that previously described. It is so situated that, in charging, the fuel falls immediately on to the ignited fuel in the furnace; while the iron, at the same time, falls on to the oven, between the fuel and the chimney.

The patentee claims:—First. The construction of smelting furnaces, for smelting iron ore, provided with air passages, and with smoke and vapour passages, and provided with dampers or valves, for the purpose of closing and opening them independently of each other. Also the air-tight, or nearly air-tight, hopper, for supplying the charges of fuel, &c., to the furnace, as described.

Secondly. The construction of an improved melting furnace for melting pig or foundry iron, of the oven-like form described, in so far as regards its construction, in the manner and for the purposes shown.

Thirdly. The application and adaptation of the oven-like form described to the construction of all ovens, for whatever purposes employed.

Fourthly. The employment and construction of the barrel hopper to ovens and furnaces, as described.

William Crofton Moat, of Upper Berkeley-street, Middlesex, surgeon, for improvements in engines to be worked by steam, air, or gas. Patent dated January 4th, 1849. Enrolled July 4th, 1849.

This specification describes a mode of packing the pistons of steam-engines, stuffing-boxes, and other similar parts, by the employment of hollow rings of soft or flexible material, atmospheric air being condensed into the interior to give it the

necessary degree of elasticity or force. The drawings which accompany the specification show the application of the invention to a steam-engine piston; the hollow ring, either of lead or vulcanized indiarubber, is placed and held between the upper and lower plates of the piston. A solid metal ring is placed in the usual position between the plates, and between the hollow ring and the interior surface of the cylinder ; a pipe passing through the piston effects a communication from the interior of the hollow ring to the piston rod, which is likewise hollow. A coil of pipe being screwed to the top of the piston rod is in connection with an air-pump, by which the air is forced in when the exterior surface of the hollow ring is forced into contact with the piston plates and the solid ring, and thus maintains it steam-tight. The drawings show the means of charging the air into the hollow ring, without the aid of the hollow piston rod; its application to stuffing-boxes is likewise shown.

The patentee claims :—The employment of flexible hollow rings or flexible tubes (no matter of what materials they are made), filled with air more or less compressed, for the packing of the pistons and stuffing-boxes of engines worked by steam, air, or gas.

William Edward Newton, of Chancery-lane, London, civil engineer, for certain improvements in steam-engines. Patent dated December 28th, 1848. Enrolled June 28th, 1849.—(Communication.)

This specification, which is a communication from abroad, relates to the construction of the steam-engine, and is divided into two parts, the first being the arrangement of the parts of double cylinder expansive engines; and the second a peculiar arrangement and construction of condenser. The inventor endeavours to prove that a great loss results from the employment of steam (in steam-engine cylinders) expansively when they are arranged and constructed in the usual manner ; and this, he says, results from the usual relative positions of the centre of the crank shaft, and the centre of vibration of the beam, in beam engines. He proposes to place the centre of the crank shaft nearer to the action of the beam than its ordinary position, in a plane near the end of it, and cutting the arc of vibration. The connecting rod he proposes to be considerably shorter than usual; indeed, he says, not more than about twice the length of the crank. The beams, also, he proposes to employ very short. The great object he states to be, to effect a greater aggregate amount of leverage for the expanding steam to operate upon. A double cylinder engine is shown in the drawings which accompany the specification, one of the cylinders being much longer than the other. The pistons of these are connected by beams and connecting rods to two cranks, fixed upon one shaft and opposite to each other, that is at an angle of 180°, so that both pistons commence and complete their strokes at the same time; the object of this is that the one or the other of the pistons is always descending in its respective cylinder, and, as the power is only exerted upon the pistons during their downward stroke, it follows that only one of them is communicating power to the crank shaft at any moment: they act accordingly alternately. The steam from the boiler enters the top of the smaller cylinder, and exerts its force upon the upper side of its piston, which thus descends ; the piston in the larger cylinder ascending, but without exerting any power, as both sides of it are open to the condenser at the termination of the stroke. The communication between the top of the larger cylinder and the condenser is closed, and a communication opened between it and the top of the smaller cylinder; by this, the steam above the piston in the smaller cylinder, passing into the top of the cylinder above its piston, forces it down, the bottom part of the cylinder below the piston being always open to the condenser. At the same time that the above communication is opened between the upper parts of the two cylinders, a communication is likewise opened from them to the lower part of the smaller cylinder, below its piston, which allows that piston to ascend, and at the termination of this stroke, the communication between both sides of the piston in the larger cylinder, and below the piston in the smaller cylinder, with the condenser, is opened, and steam from the boiler admitted to the top of the smaller cylinder, as before, for a repetition of the stroke.

The construction of condenser recommended by the inventor is very similar to an ordinary locomotive boiler, being a cylinder within which are rows of horizontal tubes, a stream of cold water being passed by means of a pump through the cylinder, and in contact with the exterior surfaces of the tubes, which are thereby cooled; the steam from the engine or boiler is admitted at one end, and passes through the lowest ranges of tubes into a chamber at the end, and then returns to the other end, through the upper ranges of these, being condensed in its passage.

The plate to which the tubes are attached at one end is fastened to the cylindrical shell of the condenser by means of a peculiar cone-like flange, so as to allow, by its slight bending, to compensate for the difference of expansion of the tubes, and of the cylindrical shell.

The patentee claims :—First. In beam engines, working by steam expansively, the placing the centre of the crank shaft nearer than usual to the centre of vibration of the beam.

Also in expansive engines having two cylinders, the cranks of each cylinder being fixed upon one shaft, but on opposite sides. That is, at an angle of 180° to each other.

Also in expansive engines having two cylinders and pistons. One side of the larger or expansion cylinder being always open to the condenser, and the other side alternately open to the condenser, and to the steam side of the smaller cylinder. The steam from the boiler being admitted to one side only of the piston of the smaller cylinder.

Secondly. The construction of condenser in combination with a pump for passing the water through the condenser.

Also the communication of this condenser with the boiler of the steam-engine, as described. Also the mode described of securing the tubes in the condenser by a diaphragm and conical flange.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING JULY 10TH, 1849.

Richard Garrett, of Leiston Works, Suffolk, agricultural implement-maker, for improvements in horseshoes, pug-mills, drilling and thrashing machinery, and in steam-engines, and boilers for agricultural purposes. Patent dated July 7th, 1849 ; six months.

Edward Ives Fuller, of Margaret-street, Cavendish-square, carriage-builder, and George Tabernacle, of Mount-row, Westminster-road, Surrey, coach-ironfounder, for certain improvements in metallic springs for carriages. Patent dated July 7th, 1849; six months.

Thomas Sedgwick Summers, of Cornwall-terrace, Lee, Kent, lighterman, for certain improvements in fastenings for the mouth of sacks and bags. Patent dated July 9th, 1849; six months.

William Laurie, of Carlton-place, Glasgow, merchant, for improvements in means or apparatus to be employed for the preservation of life and property, such improvements or parts thereof being applicable to various articles of furniture, dress, and travelling apparatus. Patent dated July 9th, 1848 ; six months.

John Goodier, of Mode-wheel-mills, near Manchester, miller, for certain improvements in mills for grinding wheat and other grains. Sealed July 9th, 1849 ; six months.

George Augustus Robinson, of Long Milford, in the county of Suffolk, gentleman, and Richard Egan Lee, of Glasgow, gentleman, for certain improvements in the manufacture of bread, and in the machinery and apparatus to be used therein; and also improvements in the regulation of ovens and furnaces, part of which improvements are also applicable to other similar useful purposes. Patent dated July 10th, 1849 ; six months.

PATENTS RECENTLY EXPIRED.

J. Vint, Colchester, Esq., for certain improvements in paddlewheels. Patent dated July 9th, 1835; expired July 9th, 1849.

R. Coad, Liverpool, chemist, for certain improvements in the means or apparatus for consuming smoke, and economizing fuel furnaces, which improvements are particularly applicable to furnaces of steam-engines employed for navigation and other purposes. Patent dated July 10th, 1835 ; expired July 10th, 1849.

W. Busk, Surrey, engineer, for certain improvements in propelling boats, ships, or other floating bodies. Patent dated July 10th, 1835 ; expired July 10th, 1849.

J. Rogers, Westminster, gentleman, for certain improvements in paddlewheels. Patent dated July 10th, 1835; expired July 10th, 1849.

C. G. Cuppler, Nuremburg Polytechnic Institution, for certain improvements in the construction of weighing-machines, and other machines used in ascertaining weights. Patent dated July 11th, 1835; expired July 11th, 1849.

F. H. Maberly, Cambridge, clerk, for a new method of propelling vessels. Patent dated July 13th, 1835 ; expired July 13th, 1849.

SELF-GENERATING GAS-LAMPS.—HOLLIDAY'S PATENT.

COURT OF QUEEN'S BENCH, WESTMINSTER, JUNE 30.

Before Lord Chief Justice Denman.

HOLLIDAY V. FAWCETT, BOTH OF HUDDERSFIELD.—Mr. Webster and Mr. Pollock appeared for the plaintiff, and Mr. Hayes for the defendant.

This was an action to try the validity of a patent taken out by the plaintiff for improvements in self-generating gas-lamps, which it was alleged the defendant had infringed. From the evidence it appeared that though several patents had been taken out for portable lamps, to burn gaseous or spirituous liquids without the use of wicks, none of them had succeeded in that object, so as to bring them into extensive use, until the improvements introduced by the plaintiff had removed the former defects, and that since those improvements had been effected the sale had been very great; and the utility of the new lamp was so manifest that many parties had commenced to make them without due licence from the patentee, and, amongst the foremost, the defendant, whose son had been in plaintiff's employ during the time that the models of the different kinds of burners patented had been made for the purpose of being set forth in the specification. In support of the plaintiff's case, Wm. Carpmael, Esq., civil engineer, of Lincoln's-inn, was called, who stated that he had been much consulted on the manufacture of lamps for burning various matters, and, amongst others, for burning naphtha. He was well acquainted with all the different forms of the vapour-lamp; and was aware that until plaintiff's lamp was introduced none of them had been successful to any extent. He was of opinion that the peculiar forms of the plaintiff's burners were new and useful. Evidence of the extensive sale of the plaintiff's lamp was also given, and the lamp itself exhibited in court in full action, producing, as Mr. Carpmael said, a very splendid flame resembling that of a gas flame or burner. It was also shown that the defendant had, in the opinion of the witnesses examined, infringed upon plaintiff's patent; and in support of their testimony sections of each burner were produced. Counsel, in setting forth plaintiff's case, stated that the action was brought to assert the right of plaintiff, and not with a view of obtaining damages. The defence was that the patented improvements were not new; and in support of this plea evidence was adduced to show that a burner for a vapour-lamp, similar to that claimed by plaintiff, had been sold and

invoiced to a party in the month of November, 1847, being nearly two months prior to the sealing of the patent. On examination, however, in court the burner proved to be essentially different. Other witnesses were also called to state that they had made burners for vapour-lamps, varying slightly from plaintiff's, before the patent, but did not produce any. An attempt was also made by defendant to show that he was not the party that sold the particular lamp on which the action was brought, but that the lamp business was his son's, though conducted in his (defendant's) shop. This portion of the evidence, however, signally failed, for it was proved that the defendant was present when the lamp was sold and the invoice was made out in his name, and receipted by defendant also. The case having been gone through, the judge, after commenting on the evidence, told the jury that, if they thought the invention of the plaintiff superior to others, it was sufficient to establish his exclusive right to make and vend the same, and he accordingly left it to the jury to say, first, whether the defendant sold the lamp on which the action had been brought; and secondly, whether the invention was new. The jury retired; and on returning to court gave a verdict for the plaintiff on both points left to them by the judge. The judge's associate on receiving the verdict stated to the jury that, having found in favour of the plaintiff's *right*, it would only be necessary to specify a nominal sum, as the plaintiff had not made it a question of damages. The jury, therefore, found damages one farthing. The judge, upon being applied to, certified for costs, which defendant will accordingly have to pay on both sides.

HEALTH OF LONDON DURING THE WEEK.

[From the Registrar-General's Return.]

The present return exhibits a serious increase in the mortality of London. The deaths, which in the previous week were 1,070, have in the last amounted to 1,369, and give an excess above the average of 361. This unfavourable result is produced by cholera and diarrhœa. The deaths from cholera were 339—more than double the mortality of the preceding week; those from diarrhœa and dysentery, which in the former week were 54, have rapidly increased to 100, which is more than in any corresponding week of five previous years. The total in the week from the three diseases is therefore 439, and makes an excess of 347 on the average of former years. The mortality from all other zymotic or epidemic diseases is 191, the average being 210; that from all sporadic diseases is 686, the average being 670. The progress of cholera in London is traced in the returns of the last six weeks, in which the numbers were successively 22, 42, 49, 124, 152, and 349; the progress of diarrhœa and dysentery in the same periods is shown as follows:—25, 38, 19, 33, 54, and 100. During these six weeks cholera was fatal to 425 males, and 303 females, of whom 387 died on the south side of the river, only 101 in the west and northern districts. Considerably more than one half of deaths from diarrhœa last week occurred under two years of age; whereas, of the 339 deaths from cholera, 192 occurred between the ages of 15 and 60. Last week 49 persons died of cholera in the district of Lambeth, 37 in Rotherhithe, and 23 in Bermondsey; but the epidemic now increases generally over the metropolitan districts. Hoopingcough, pneumonia, and phthisis are at present fatal to more than the usual number; the second, as well as the first, almost entirely to young persons. Typhus, measles, scarlatina, and smallpox are about the average, or fall considerably under it. Two men died of intemperance.

The barometer has been high during the week. It reached 30.252 in. on Wednesday, and the daily mean was above 30 in. throughout the week, with the exception of Sunday. The mean of the week was 30.129 in. The temperature of the air was highest on Sunday, when it reached 84°.1 in the shade, and 109° in the sun, at Greenwich. The mean of the week was 66°.8, considerably higher than in previous weeks. It was throughout higher than the average of the same week in seven years, and the mean on Sunday exceeded the average by 9°.5.

ON THE DETECTION OF CHLOROFORM IN THE BLOOD.

By RAGSKY.

The presence of chloroform cannot be readily detected by chemical means in the blood, on account of the very small proportion contained in the circulating fluid; for after inhalation a few drops of chloroform have become mixed with about thirty pounds of blood contained in the body. The author, therefore, invented the following process, by which he succeeded in detecting the presence of chloroform in the blood, employing for his experiment at least one ounce of blood, either just extracted from the body, or which had been carefully preserved in a well-closed vessel subsequent to its abstraction.

Mr. Ragsky's method is founded on the fact that chloroform is decomposed by a red heat into carbon, muriatic acid, and chlorine. His process consists in introducing the blood which is to be examined into a flask, the cork of which is perforated by a curved glass tube. The horizontal portion of this tube is made red hot during the experiment. Into the extremity of the tube a strip of paper coated with iodide of potassium and starch paste is introduced. The flask is then placed in a water-bath, and the water is made to boil, in order to volatilize the chloroform, which is decomposed in the red-hot portion of the tube; and the chlorine thus set free, reacting on the iodide and paste, produces a blue colour. By this test the millionth part of chloroform can be distinctly discovered. The author has made repeated experiments with the blood of healthy and diseased individuals who had not inhaled chloroform without obtaining the same result.

The narcotism from chloroform is, according to the author, more lasting than that from ether; the cause of this may be that the boiling point of chloroform is higher than that of ether. On the other hand, the narcotism of the first is followed by a greater relaxation. The author believes that the cause of the narcotism is the circumstance that the vapours of the ether and chloroform possess a much higher degree of tension than the vapour of water, and, therefore, replace the latter in the organs. Most organic substances contain much water; the lungs, the liver, &c., about seventy-five per cent. The increased pressure which the vapour of ether or chloroform exercises may, therefore, be the cause of the narcotism.—*Journ. für Prakt. Chem.*, Bd. 46.

Poisoned Water.—It is not generally known to the public that the carbonic acid or fixed air in water decomposes lead pipes, and therefore imparts poisonous properties to the water. Within the past few months Sir Raymond Jarvis, of Ventnor, had occasion to repair the pumps which supplied his mansion, when, to his amazement, it was found that the large leaden feeding-pipe was almost entirely eaten away by the water, and the interior covered with a white and poisonous crust. Sir Raymond has had the whole replaced with gutta percha tubing, which, from its extraordinary alkali and acid-proof qualities, will preserve the water perfectly pure. It seems remarkable that, at the moment when our sanitary movements have commenced with so much vigour, gutta percha should have come to our aid, not only as a means of preserving the feet from damp or wet, but also as a medium for supplying us with the best of liquids—water, untainted by the deleterious properties which we have endured by the use of leaden pipes.

Hydraulic Cement.—Powdered furnace-slag, mixed with burnt lime, furnishes, as is well known, an excellent hydraulic cement, and Elsner proposes a test to discover easily those slags, and also minerals which are best suited for the manufacture of cement, namely, those which when powdered and treated with muriatic acid yield in the shortest time siliceous jelly.—*Pharm. Central Blatt.*

On Xyloidin and Gun-cotton.—Xyloidin, and still more so gun-cotton (fulmi-cotton), are idio-electrics, and by friction with the dry hand become to a high degree negatively electric. Clothing (as shirts and jackets) manufactured from this material, and worn on the bare body, must, therefore, exercise a medicinal effect by the electricity which they produce through the friction of the skin, and a chemist in Russia has recommended the use of shirts, &c., made of calico and similar materials which has been steeped in a mixture of nitric and sulphuric acids, or of nitre and sulphuric acid.—*Med. Zeitung Russlands*, 1846, N. 28. The application of gun-cotton for such purposes is, however, very dangerous, since the spontaneous combustion of the same is often caused by the slightest circumstances.—*Buchner's Repertorium.*

TO CORRESPONDENTS.

"Beta."—The separation of the phosphoric acid from strong bases is effected most expeditiously and accurately by means of nitric acid and metallic mercury. The process is as follows:—Dissolve the phosphatic compound or the mixture of phosphates in nitric acid, taking care to use neither too much nor too little of the acid. Pour the solution now into a small porcelain dish, not too small, however, lest loss should occur from ejection. Add to the solution metallic mercury, until the free acid ceases to dissolve this metal; you must take care to have a small portion of undissolved mercury in the mixture. Evaporate the mixture to perfect dryness in a water-bath. Should the dry, warm mass retain the slightest smell of nitric acid, you must moisten it with water, and evaporate again in the water-bath, repeating the same process, until the dry, warm residue no longer retains the slightest smell of nitric acid. Treat the residue now with water (either hot or cold), and filter through a very small filter. Wash the undissolved residue on the filter thoroughly. You may readily ascertain whether the operation of washing has been carried far enough simply by evaporating a few drops of the rinsings on a platinum plate, and igniting the residue, if there be any; if no residue is left upon ignition, you may take it for granted that the mass is thoroughly washed. In the filtrate you have all the bases of the original phosphates in combination with nitric acid, along with a considerable quantity of protonitrate of mercury, and some pernitrate. The residuary mass in the filter contains protophosphate of mercury, protonitrate of mercury, and metallic mercury.

"H. W."—The mistake has been rectified.

"W. C. R."—Take acid of 1.04 sp. gr.

"Mr. Morley, Bristol."—You had better apply to Mr. Carpmael.

"A. B."—At Birmingham. Last year at Swansea.

"Mr. Millar, Kennington."—It is a difficult question to decide. Our opinion is adverse; but we do not know the subject sufficiently to speak with full authority on it. You had better consult some person more competent to judge of the matter than we are.

"John Bull."—The electuary for the cholera consists simply of equal parts of finely-powdered and newly-burnt charcoal, lard, and maple sugar. We would not advise our correspondent to rely on the efficacy of this remedy.

The Chemical Times is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentleman may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary or scientific communications to be addressed to the Editor, 320, Strand.

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ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

Part II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXVI.

(LECTURE XCIX.)

VEGETO-ALKALIS—(*Continued*).

OPIUM.

PHARMACEUTICAL PREPARATIONS OF OPIUM.

Notwithstanding the numerous investigations and the careful study of which opium has been the subject, there prevails still considerable doubt and uncertainty regarding the exact composition of this vegetable product. That morphia is the principal agent in the production of the medicinal effects of opium admits of no doubt; but we are not quite positive yet whether or not the narcotina and codeïa contribute to the medicinal action of the substance. We know from the results of certain experiments that meconia, narceïa, and thebaine are in the isolated state without medicinal action; but we cannot say whether these principles may not exercise a certain action notwithstanding, when in combination with the other matters with which they are associated in the opium. Moreover, it is still a matter of doubt whether all the substances which the chemist has extracted from opium actually exist in that vegetable product, or whether some of them may not have been formed under the influence of the agents used to effect their extraction.

However, there are some well-ascertained facts which, although not of a nature to give us a positive insight into the various modifications which opium may suffer respectively by the different methods and processes to which it is subjected in the pharmaceutical laboratory, will yet throw some light upon these modifications, and may, accordingly, be turned to account in the respective appreciation of the several pharmaceutical preparations of that substance.

As we have already seen, the various sorts of opium of commerce, namely, the opium of Smyrna, that of Constantinople, and that of Egypt, contain, respectively, very different proportions of morphia. The Smyrna opium, which is the best of all, containing, as it does, from 16 to 24 grammes of morphia per kilogramme, should, therefore, alone be used by the apothecary.

Section I.—PREPARATIONS CONTAINING THE WHOLE SUBSTANCE OF THE OPIUM.

The opium is dried, and, when dry, reduced to powder. It is very seldom used in this form except, perhaps, to sprinkle over poultices.

Section II.—PRODUCTS OBTAINED BY THE ACTION OF WATER UPON OPIUM.

Cold water extracts from opium the whole of its soluble principles, viz., the natural salts of morphia and codeïa, the brown extractive acid, and the gum; a portion of the narcotina, narceïa, meconia, thebaina, fatty oil, and resin, are equally dissolved under the influence of the soluble principles.

Boiling water dissolves a larger proportion of the resinous matter than cold water. Infusion of opium is sometimes used externally to combat pain.

OPIATED NARCOTIC LOTION OR FOMENTATION.

Take of Crude opium, 8 grammes.

Boiling water, 1,000 grammes.

Reduce the opium to a coarse powder, pour the boiling water over it, and let the mixture infuse for two hours, taking care to stir it from time to time. Strain, let it settle, and decant.

DISTILLED WATER OF OPIUM.

Take of Crude opium, any given quantity.

Water, a sufficiency.

Distil to draw off one part of product.

This preparation is recommended by some, repudiated by others. To me it appears one of the most uncertain and inefficient preparations of opium. This much is certain, that it cannot contain any of the fixed principles of the latter.

EXTRACT OF OPIUM.

The extract is the best known and most frequently employed of the aqueous preparations of opium.

It is prepared in the following manner:—

Cut the opium in slices, and let the latter macerate for twelve hours in six times their weight of water. Malaxate the mass, and let it stand at rest for twelve hours; strain through linen, with strong squeezing of the grounds. Subject the latter once more to the same operation. Add the strained liquid of the second to that of the first operation, and evaporate to the consistence of an extract. Redissolve the product in 16 parts its own weight of cold water; strain the solution, and evaporate the strained liquid again to the consistence of a pilular extract.

Opium yields somewhat less than half its weight of extract.

We have seen that water dissolves the salts of morphia and of codeïa, the narcotina, gum, and extractive, and also a portion of the resin and of the fatty oil. Upon the concentration of the liquors, however, a considerable proportion of the latter two principles separates again in conjunction with narcotina. The separated mass has been compared to resin; it contains no morphia; the narcotina in it appears to be saturated by the resin and the fatty oil.

This separation of the narcotina, the resin, and the fatty oil tends to heighten the medicinal efficacy of the extract of opium. By repeated alternate processes of solution and evaporation, nearly the whole of these admixtures may be removed from the extract. This is very rarely done, however.

The extract of opium is usually administered at the dose of a few centigrammes. It forms also an ingredient of a great many pharmaceutical preparations.

EXTRACT OF OPIUM FREED FROM NARCOTINA.

Dilute the simple extract of opium with a sufficient quantity of water to obtain a mixture of syrupy consistence. Introduce the syrupy liquid into a glass flask, and add to it eight times its volume of sulphuric ether. Let the mixture stand for one or two days, with occasional shaking of the flask. Decant the ether, and add to the grounds in the flask a fresh quantity of ether equal to the first. Let the mixture stand again for one or two days, with occasional shaking, and then decant the ether. Repeat the same operation until the ether refuses to effect any further solution. Evaporate now the syrupy liquid in the flask to the consistence of a pilular extract.

This is Robiquet's process. It has been adopted by the Codex,

To M. Limousin-Lamothe we are indebted for the following more economical process. Take four parts of extract of opium and one part of common resin. Dilute the extract of opium with water to a syrupy liquor, add to this the resin, and heat the mixture to boiling. Keep it boiling for ten minutes, with constant stirring. Let it now cool, remove the resin, and evaporate the liquor to the consistence of an extract.

In this process the narcotina, resin, and oil of the opium form with the common resin, which possesses analogous properties, an insoluble mass, which separates with greater facility from the aqueous solution than the same principles could have done previous to the accession of the additional quantity of resin.

M. Limousin the younger has proved experimentally that this treatment with resin removes not only the narcotina, but also a larger proportion of the resin and oil than is done by the process of the Codex. From fifty grammes of extract of opium he obtained 2.3 grammes of narcotina, oil, and resin. From the same quantity of extract, previously treated with ether, he obtained one gramme of these substances. From the same quantity, treated previously with resin, he obtained only one decigramme of oil and resin.

M. Magendie believes the extract of opium freed from narcotina to be more sedative than the common extract, which is, of course, quite natural, considering that it contains a larger proportional amount of morphia than the latter. But he believes it also to be less stimulating. This opinion is combated by several eminent authorities. It will require a carefully conducted series of therapeutical experiments to show whether it is correct or not.

ABSTRACT OF AN INTRODUCTORY LECTURE ON CHEMISTRY.

By Professor MILLER, of King's College.

The object of my course of lectures on chemistry will first be to assist you in arranging the already considerable mass of information on various subjects connected with chemistry which every one with a moderate share of observation and common sense must have acquired; and to enable you to use the facts you possess, after having ascertained that your knowledge of those facts is accurate; and next to put you in the way of reducing them under more general and comprehensive heads, termed laws. The laws of natural philosophy are in truth but mere general expressions, including a number of particular cases. Knowledge to be useful must be particular, detailed, and special; but it does not follow that all knowledge consists in an accumulation of facts. Were that the case, our time here would not be sufficient for the attainment of ordinary skill on common subjects. The mind follows its own inherent tendency to generalize, and, when it cannot discover laws, it frames hypotheses concerning them. The use of those laws is to dispense with the burdensome acquisitions of particular facts, and they enable us to predict with certainty what will happen in a future and special case. It is not necessary for me to try the experiment with this ruler whether, when I relax my grasp, it will fall or not; although I have never seen it fall, I know that every ruler does fall under those circumstances; further, I know that this property is not confined to rulers, but that every body, whether wood, stone, iron, &c., will do the same; because the general law is, that all bodies left unsupported fall towards the earth. The facts here mentioned were known, of course, 5,000 years ago, but no further inquiry was made. No one asked, why does not the earth fall? or, if any one did, no reference to any known principle could be assigned, until Newton gave us the true reason, which, when once known, is as simple as conclusive; his suppositions being not only that all bodies fall towards the earth, but that the earth in return falls towards all those bodies that approach it; that action and reaction are equal, and consequently the force that draws all bodies towards the earth must in like manner draw the earth towards them. Newton did not bound his supposition by the limits of our globe, but conceived the bold and happy idea that the same attraction counteracted by an impulse operating at right angles to it, in accordance with the then recently-discovered laws of motion, might hold the moon in its place near the earth; account for its motion round our globe; might maintain the earth and the other planets in their courses near the sun; and by analogy extended the same powers of reasoning to all the innumerable suns and systems which fill the universal space.

Our knowledge of natural science must, nevertheless, in the first instance be based on natural facts; those falling most within ordinary observation may form essential contributions towards the foundation of our philosophy.

The use of hard and high-sounding words is no proof of profundity on the part of him who employs them. Bacon pointed out the cheat played on the mind by passing off names for ideas. No authority can justify the use of new names for old ideas when the terms we have are sufficient for the purpose, and convey the precise meaning intended without risk of mistake.

Precision in science is, however, of such vital importance, that the signification of the words it makes use of requires a much more rigorous definition than is the case in common language; and thus it happens that new words are necessarily employed for familiar ideas when the terms by which they are usually expressed are of a vague and general nature, and applicable to more than one object. The progress of science, moreover, furnishes us with new ideas which we are required to name, and new terms then become indispensable. Remember, however, that science consists in the application of common sense to the investigation of daily occurrences; which investigation leads, by a process of induction, to the discovery of general principles, that may afterwards be applied to the determination of new and unsuspected facts of a kindred nature. "We must not forget that it is *principles*, not phenomena—*laws*, not insulated facts, which are the objects of inquiry to the natural philosopher."—*Sir John Herschel.* Facts being our primary requisite, observation is our first guide. In observing, we must learn to distinguish carefully between the essential and the accidental. This will lead us to experiment, which is only observation in a more active form—a process in which nature is questioned and cross-examined till we obtain direct answers to our inquiries. According to our skill in conducting this inquiry will be our success; the simpler, more comprehensive, and accurate our experiments, the more precise and valuable the information we acquire. By observation and experiment we arrive at particular laws. Although the proper use of experiments is such as I have named, there is a secondary use of much importance. Experiments are employed as means of demonstration, as proofs of principles known to be correct; the excellence of such experiments consists, not in their beauty, but in their adaptation to the object in view.

Analogy, and the use made of it by Newton, have already been mentioned. "Design," it is well observed by Professor Daniell, "soon becomes apparent in the order of creation; and this design, so far as our limited faculties can trace it, is uniform, and in the system of the universe every part is, doubtless, proportioned to the whole. Only one eye can comprehend the universe, but from such portions as we have mastered we are often enabled successfully to anticipate the order of other portions, and thus to obtain a guide to experiment, to which an ultimate appeal must always be made." This tracing of resemblances is one of the principal instruments employed in the search of truths, but it is one requiring the most guarded care. It is indispensable; and yet, in the hands of the careless or inexperienced, nothing leads to greater mistakes. A facility of wielding it marks the distinction between the successful and unsuccessful votary of science. Analogy is our main guide in the discovery of general laws.

We have now enumerated the three chief instruments for acquiring—observation, experiment, and analogy or comparison. But the acquisition of precise modes of thinking is not less necessary than the possession of materials for its exercise. The mere reception of truth is valueless: it must be assimilated, and made a part of the mind. Just as the body cannot be sustained without material food, and yet this very food, if undigested or taken in excess, clogs the stomach, and impairs its power; so the mere loading the memory with facts, needful as they are to the healthful growth of the mind, speedily overpowers it, unless, by due reflection, they are digested, and stored up so as to contribute to its activity. Thought is to the mind what exercise is to the body.

I now come to speak more particularly of that branch of knowledge which it is my province to teach. From the very humble and unpromising origin—amid the visionary speculations of the alchemist in his search for the imaginary philosopher's stone, and for the not less chimerical *elixir vitæ*—chemistry has at length obtained a position, if not foremost, at least among the very first of those sciences which minister to the necessities and comforts of man, and which open to him the most exalted views of the Creator, and supply materials for the speculations of the most refined intellect. To expatiate on the importance of this wide-spreading science is not now my object. The absolute necessity of its study by all who would keep pace with the rapidly advancing progress of professional knowledge, of agricultural improvement, or of manufacturing industry, is self-evident; and its high value as a branch of liberal education is forcing itself upon the consideration of those who have hitherto regarded it as a mere technical art, unable to contribute in any degree to the improvement of the mind in the development of the intellectual powers. Surely a science which wields the gigantic though silently operating forces by which this material world is made to undergo its ceaseless but unerringly-regulated cycle of alternate decay and renewal—a science which, with the properties of heat, teaches us to control and distribute a power which is not less essential to our existence than the air we breathe—a science which teaches us to disarm the tempest of its fiery bolt, which enables us to evoke the subtle magnetic influence from the feeblest chemical combination, and to store it for our use in the needle that points the way through storms and darkness over the trackless ocean—a science that can extract from the sunbeam a force that may be treasured up for centuries, but can in a moment be made to reassert its sway; that can engrave upon the imperishable surface of metal each shifting scene as it passes in quick review before our eyes—a science which, in addition to all these wonders, can teach us the composition of the atmosphere we inhale, which guides the husbandman in his toils, which points out the mode of separating the gold from the dross, the jewel from the earth which surrounds it, and which converts a useless mass of clay into the iron which gives a characteristic to our age;—a science of which these are but a few of the applications can no longer be looked upon with indifference. It must assert its sway; and it is daily rising to claim the station which it deserves among the powers that be.

But apart from these advantages, and considered merely as a means of mental training, it would not be easy to find one pursuit so fascinating to the ardent and vigorous mind. It unites what Bacon calls "the comfort of imagination with the industry of trial." It combines intellectual exertion with the bodily exercise which its manipulations require, and thus almost realizes the ideal perfection of an occupation.

In chemistry all the resources of the most ingenious, the patience of the most persevering, the fancy of the most imaginative, and the curiosity of the most inquiring, may meet with ample scope; not for the occupation of mere idle moments, but for the energies of long-sustained and unwearied attention. Nay, more; to those ambitious of acquiring honourable distinction among the cultivators of science, what mine opens more boundless treasures, or holds out more certain promise of rich reward? Look to the history of some of the brightest names in philosophy—they are enrolled among the followers of this noble science; let us trace their origin, and view them in their ascent to the eminent position they adorned and dignified. Who was Sir H. Davy, the discoverer of the compound nature of the alkalis and earths, the acute investigator of chlorine, the inventor of the safety-lamp, and for thirty years the great luminary of chemical science? He was the son of poor Cornish parents, apprenticed to an apothecary, his laboratory a garret, his apparatus a few glass phials, bladders, and tobacco-pipes. Who was Dalton, who not long since descended to the tomb full of honours—the man who stamped precision on chemistry, and who first gave it a title to the rank of an exact science, by his happy discovery of the laws of combination?* He was usher in a private school, and was for many years compelled to take pupils in mathematics to earn a scanty subsistence. Who was Scheele, the great rival of Lavoisier and Priestley; one of the great founders of pneumatic chemistry, and the discoverer of a larger number of elementary substances than any one before or since; a man of whom his patron, Bergmann—himself one of the profoundest chemists of the time—said, and truly said, "that his greatest discovery was the discovery of Scheele"? Scheele was the shopboy, the drudge, of a village apothecary. To come to our own days, Faraday was a bookbinder's apprentice; Dumas, the first chemist in France, rose from a station little higher than Scheele; and Liebig, the leader of the German chemists, was the son of a small trader in Darmstadt.

[*To be continued.*]

HIGHLAND AND AGRICULTURAL SOCIETY'S CHEMICAL DEPARTMENT.

Mr. Finnie, of Swanston, delivered the following address at the general meeting of the society, on the 11th of July:—

"It cannot but be gratifying to every one connected with agriculture that the Highland Society should have, in so satisfactory a manner, completed its arrangements with regard to the appointment of a chemist, not only as respects the object it has in view, but in the selection made, more especially when we witness the laudable exertions, both of the English and, I believe, the Irish Agricultural Societies, to aid by science the operations of the practical farmer. But, as convener of one of the committees appointed for the purpose of obtaining subscriptions for the chemical department, I must say, and I believe I speak the sentiments of the other conveners, that, unless the proprietors and occupiers of land come forward more promptly and decidedly than they have as yet done, little credit will redound to the agricultural community of Scotland for the step the society has taken—(applause)—for, assuredly, unless funds be provided, the society will be thwarted in its efforts, and not only will its reputation be endangered, but, in failing in its endeavours successfully to induce practical farmers to avail themselves of the aid of science, a lower status must be taken by the agriculturists of Scotland amongst those of the other countries in Europe—(Hear, hear). I can to a certain extent, but not altogether, apologize for the apathy evinced towards the chemical department of the society by the tenant farmers, aware, as I am, with what they have had to contend with during the past two years. But it must be a serious disappointment to every one who has either the interest of agriculture or this society at heart that so very large a proportion of the proprietors of land should be lukewarm and indifferent to a matter which not only embraces, but will materially tend to advance, the agriculture of Scotland, and elevate its tenantry to a still higher standard of intelligence. I am aware some are exceedingly sceptical as to whether chemistry can benefit agriculture at all. To all such I would respectfully say, such an idea exists from the want of inquiry; and, if not presuming too much on the indulgence of this meeting, I may state, in a few

* Professor Miller seems to claim the honour of this discovery for Dalton. In this we must beg to dissent from the learned professor. Dalton unquestionably *established* the laws of combination, but he certainly did not *discover* them. The merit of the *discovery* is due to Wenzel (1777); Bergmann, Richter, and Higgins may also justly claim some considerable share in the establishment of these laws.—[Ed. *Chem. Times.*]

words, in what respect I myself, a practieal farmer, have experienced aid from it—(Applause). I had a field of fifty acres, which I thought, and am sure would have been supported in the same conclusion by nine out of ten of any farmers I might have eonsulted, would be much benefited from lime. Eight acres were limed, at an expense of about 85s., including carriage. It then occurred to me I would have an analysis made of the soil, and was informed it contained a fair proportion of lime. I desisted; treated the whole fifty acres alike as regarded other manures, and, after a lapse of some six or seven years, am now convinced that the lime would have made no return. Then, with regard to another point of my practice, I happened to have some poppy-cake brought under my consideration by a Leith merchant to which it was consigned. Never having been known as used for feeding purposes in this country, or, I believe, any other, the offer I had of it was at such a price as to admit of it being used for manure. I bought the poppy-cake—an unfavourable spring ensued—when I was compelled to give my hill-stock ewes forced feeding. I thought of using it, but was deterred, thinking that something deleterious might be in it, and, more particularly, as lambs were in the question, double caution was necessary. I sent, therefore, a sample for analysis, along with another of good foreign linseed-cake, and to my agreeable surprise it was found to contain not only more oil than the linseed-cake, but to be otherwise most likely to suit rearing animals better. I gave it immediately to a breeding stock of six hundred ewes, and never had both ewes and lambs brought through in better condition, and, in such circumstances, at so little expense. Since then, I believe, some of the best breeders have used it, and it has even been sent from this eountry to India for the purpose of feeding horses, in consequence of the information obtained from me by an extensive Glasgow merchant. I should state, however, that my after experience proves that good poppy-cake is the exception and not the rule. But I may ask, would I not have lost the particular advantage I secured upon that occasion had it not been for the services of Professor Johnston, the ehemist of the Agricultural Chemistry Association, by whom the analysis was made? But I hold that all I have stated is but a drop in the bucket in comparison with the advantages to be obtained, and which I myself have experienced, from the analysis of portable manures, sueh as guano, bone, rape-cake, and the many manufactured articles now supplied to the agriculturists, and used to an incredible extent, and upon which, I may almost say, the one half of the green crop land in Scotland is dependent. We have satisfactory evidence that our guanos have been adulterated. We have had oyster shells, and such like, ground down and mixed with bone dust; and numerous are the manufactured manures likewise, the fertilizing properties of which we cannot judge of in any other way but upon chemical principles, and in which those that offer them have no further interest than to secure a sale. In illustration, I may state, some years ago I joined with two or three farmers in the purehase of some tons of nitrate of soda. None of us derived any benefit from the application of it. Most fortunately I had some left—got it analyzed by Mr. Kemp at the eollege; and then the secret was explained—it was to a great extent mixed with common salt. I heard of a cargo shipped to a party in London: a chemist was ordered to examine it before being taken from the ship. The adulteration was detected, and immediately the ship was ordered off to Scotland, and sold amongst the farmers. I once purchased a quantity of guano from a party in Leith. Professor Johnston had given an analysis of it, but the sample sent to him had been very different from the stock. I found upon taking delivery that all was not right. I then had a sample from the stock analyzed, and had no difficulty in procuring an abatement of 10 per cent., from difference of value. I cannot conceive how any agriculturist who expends his hundreds a year upon portable manures is justified in applying them before being tested, and can grudge a few shillings per annum to obtain a chemist of skill who could satisfy him as to the purity of the article upon which he is not only expending a large sum of money, but upon the genuineness of which his green crop, and every succeeding crop in the rotation, is dependent; for, without a knowledge of the nature and properties of the materials employed by the agriculturist, it is evident that the result of many of the laborious and expensive processes incident to his daily occupation must be a matter of mere chance—thus contributing more than anything else to the precariousness of the profits upon which his prosperity depends. I may be told that this is a tenant's question, and let him look after his own interest and he will fare the better; but I hold whatever is necessary for the tenant cannot be dispensed with by the landlord; and if the former, for not having a ready and cheap way provided for analyzing his manure, loses his crop in consequence, is not the landlord's rent endangered? But I would respectfully submit that these portable manures, now so important an element in good farming, and for which I would say a chemist's services are required, leaving every other consideration alone, have done much already for the proprietors of land. It is well known that during the Freneh revolutionary war land attained a fictitious value, and in its downward progress, and before reaching that point when landlords and tenants should have started again on fair terms, it was arrested by the introduction into this country of those very portable manures; thus affording a full supply of manure in localities where formerly it could not be obtained, and carrying cultivation to land naturally good, but inaccessible to cartage, and causing luxuriant crops of corn and grass where only stinted herbage appeared before. In illustration I may state, that in the year 1814 the declared value of bones imported into this country was somewhere about £500; in 1823 it rose to £15,000; and in 1837 to £255,000. In 1815 the quantity of rape-seed, rape-cake, and linseed-cake imported was only some 16,000 cwts.; in 1837 it rose to nearly 800,000. In 1814 the guano imported was only some 1,700 tons; in 1837 it amounted to upwards of 220,000. But, it may be asked, what have those statisties to do with the appointment of a chemist? In the first place, as I said before, our bone dust is adulterated, and not only so, but likewise our rape-cake. 2. To such an extent is linseed-cake and rape-cake adulterated, that, from a calculation I once saw, if the whole rapeseed and linseed grown on the Continent was converted into cakes, it is questionable whether it would amount to what is exported; and we know well to what an extent foreigners use these articles themselves. 3. Then, as to guano, we have a difference of value to the extent of £7 in the price of a ton; and will any be bold enough to say that adulteration can otherwise but exist; and how necessary to have a test applied before purchase? But already we have experienced in this country the value of a chemist. In 1841 guano sold as high as from £22 to £28 per ton. In 1842 the Agricultural Chemistry Association came into existence. Professor Johnston analyzed the natural guano, published a receipt for what was then termed British guano, and, immediately upon the attention of manufaeturers being directed to it, the public had it offered to them in any quantity. No doubt an increased importation lowered the natural guano to a eertain extent, but, in eonsequence of that produced by manufacture, the other was affected to the extent of some £6 or £7 per ton. If, therefore, it has been in a great measure owing to the industry, skill, and perserverance of the Scotch farmer that Scotch agriculture has assumed the proud position it now occupies; if it has been found that tenant farmers were the first to take steps still further to advanee agriculture, by applying science to practice, through the medium of the Agrieultural Chemistry Association, which they originated themselves; and now, when the Highland Society, with the reputation throughout Europe of being supported by the landed proprietors, has said, dissolve your Chemistry Association, as we are ready to afford you all the benefits you expected from it, have the farmers not some reason to complain, if this society is unable to fulfil what it has promised and is willing to confer, in consequence of 1,000 out of about 1,200 proprietors, who are all members of it, refusing to to give a small pittance per annum for a matter which not only concerns themselves and their tenants, but our national character as agriculturists; and, instead of fostering, thereby damping that enlightened enterprise which evinced itself when they established the Agricultural Chemistry Association?—(Applause.) I feel confident that no proprietor will be so ungenerous as to suppose I have any want of respect for the landed interest in making these observations. I disclaim being affected by any interested or unworthy motives; my only ambition is, if in my humble sphere I can do anything for that art I practise. For, whether we take a comparative view of the present state of agricultural science with its condition but a few years since—or a glance at the rapid improvements which have been effected in the arts of tillage and drainage—or the superior quality and greater abundance of crops on an average of seasons—or the progressive improvements in the breeding of sheep and cattle—and the striking advantages whieh the agriculture of this day possesses over that of only a quarter of a century past—and reflect that all such is not confined to England, Scotland, and Ireland, but extends to countries with more favoured climates, and lands naturally productive, well may we conclude that this is not the time to be found unwilling to proceed with whatever may tend to advance the art of agriculture in Scotland.—(Applause.)

FERMENTED PHARMACEUTICAL PREPARATIONS.

By BUTLER LANE, M.D.

[From the *Pharmaceutical Journal.*]

I beg to direct the attention of your numerous pharmaceutical readers to a new and peculiar method of medicinal preparation, which I think will soon receive the sanction of the medical profession, and is calculated to supply a desideratum in pharmacy. It consists in the application of fermentive action, with the view to effect the solution and preservation of the active principles of different drugs. I believe that these objects may be thus effected more economically, perfectly, and permanently, than by our present infusions, decoctions, and tinctures. The process is thus carried out:—1stly. By obtaining an aqueous solution, more or less perfect, of the active medicinal principles; in some instances the active matter will, perhaps, in the first place, be merely suspended, or mechanically diffused, through the aqueous menstruum. 2dly. By adding sugar in the proportion of at least three parts to eight, in order to afford pabulum for the formation of alcohol. 3dly. By exciting active fermentation by the admixture of yeast, and the equable maintenance of a warm temperature (65° to 75°) during a period of from four to eight weeks. 4thly. By clearing and fining the vinous liquor, and then placing it in closed vessels ready for use.

I have applied the fermenting process to numerous drugs, and have succeeded in obtaining elegant and efficacious preparations, in many respects superior to any others in use, and which have been highly appreciated by those who have given them a trial. Senna, opium, gentian, rhubarb, bark, hemlock, henbane, ipecacuanha, valerian, foxglove, catechu, aloes, squill, ealumba, cascarilla, hop, sarsaparilla, &e., are available for the process, whieh is, however, much more facile of application in some instances than in others. I intend giving full details at a future period, and shall be happy to afford any information in my power to any one who may think proper to apply to me on the subject.

CHEMICAL TABLES, ARRANGED FOR THE CHEMICAL TIMES,

By GEORGE CALEY, Esquire, 2, Mortimer-terrace, Notting-hill, Kensington.

TABLE SHOWING THE BLOWPIPE REACTIONS OF THE ACIDS AND ELECTRO-NEGATIVE CONSTITUENTS.

DIVISION OF INORGANIC ACIDS, ACCORDING TO THEIR DEPORTMENT, WHEN HEATED IN A TEST-TUBE WITH CONCENTRATED SULPHURIC ACID.

A.—*Compounds which Evolve a Coloured Gas when Heated with Sulphuric Acid.*

Iodides evolve violet vapours of iodine, accompanied with sulphurous acid. In concentrated solutions, or in operating on large quantities, iodine deposits as a black powder.	- - Addition of a little peroxide of manganese to the mixture of iodide and sulphuric acid promotes considerably the evolution of iodine, and renders its detection easier, when operating on small quantities. In this reaction no sulphurous acid accompanies the disengagement of iodine. If a small portion of starch paste is exposed to the vapours on the extremity of a glass rod, or upon a piece of paper large enough to cover the mouth of the tube, the starch, after a short time, will assume a blue, brown, or reddish colour, according to the amount of iodine liberated. When an iodide is fused into a bead of microcosmic salt, saturated with oxide of copper, a greenish colour, different in appearance to that given by the saturated bead alone, is communicated to the outer blowpipe flame. Heated with bisulphate of potash in a test-tube, the iodides evolve violet vapours, together with sulphurous acid.
Bromides disengage pungent yellow vapours of bromine, which condense in drops on the upper part of the tube.	- - With respect to the addition of peroxide of manganese, the same remarks apply to the bromides as to the iodides. Starch is coloured yellow when submitted for some time to the action of bromine vapour. Bromides heated before the blowpipe with a bead of microcosmic salt and oxide of copper impart a greenish-blue colour to the exterior flame: when fused with bisulphate of potash, sulphurous acid and yellow vapours of bromine are evolved.
Bromates give off reddish-yellow vapours consisting of a mixture of bromine, which imparts a yellow colour to starch, and of oxygen gas, which accelerates the combustion of an ignited combustible.	- - Alkaline bromates when heated alone evolve oxygen gas, leaving a residue of bromide, which behaves with reagents as described above. Heated on charcoal, they deflagrate; in a test-tube with cyanide of potassium, or phosphorus, they detonate violently. By this reaction they are easily known from the bromides. From the iodates the bromates are readily distinguished by the reddish-yellow colour of the vapour given off on treatment with sulphuric acid.
Nitrites separate ruddy fumes of nitrous acid, which are immediately absorbed by water, forming a colourless solution.	- - The nitrites, like the nitrates, chlorates, bromates, and iodates, deflagrate when heated on charcoal. Nitrites do not, like the nitrates, attack leaf gold when mixed with hydrochloric acid, a property by which these salts may be distinguished from each other.
Chlorates evolve greenish-yellow vapours of chlorous acid resembling the odour of chlorine. Very small quantities must be operated upon, otherwise a violent explosion may occur.	- - The chlorates deflagrate when heated on charcoal, and detonate violently if heated with cyanide of potassium in a tube. In these experiments very small quantities must be used, as dangerous explosions are likely to ensue. They give off oxygen when heated, leaving a residue of chloride. Heated with bisulphate of potash, yellowish-green vapours of chlorine and oxygen are given off. The chlorates, like the chlorides, impart a beautiful blue colour to the exterior blowpipe flame when fused into a bead of microcosmic salt containing oxide of copper. From the nitrites they are distinguished by the colour of the gas evolved on treatment with sulphuric acid.
Hypochlorites yield greenish-yellow vapours of chlorine gas, which bleaches moistened litmus-paper exposed to its action.	- - They are easily decomposed by heat, evolving first a little chlorine, a mixture of chlorate and chloride remaining. By this reaction, conjoined with their behaviour with sulphuric acid, the hypochlorites are distinguished from all other compounds.

B.—*Compounds which Evolve a Colourless Gas when Heated with Sulphuric Acid.*

Chlorides yield acid vapours of hydrochloric acid, which diffuse in dense white clouds, when a rod moistened at one end with liquid ammonia is held in the orifice of the tube. Addition of a little peroxide of manganese to the mixture causes the evolution of chlorine, known by its greenish colour and peculiar odour.	- - When a chloride is heated with a bead of microcosmic salt, saturated with oxide of copper, before the blowpipe, the outer flame assumes a purplish-blue colour. With other salts the flame is either green or bluish-green; by this reaction the chlorides are distinguished from other compounds. Berzelius recommends the following method for ascertaining the presence of a chloride:—A solution of sulphate of copper or iron is placed in a bright silver spoon; the substance to be examined for chlorine is then added to the solution, which is evaporated. If chlorine be present a black stain will be found upon the silver. Insoluble chlorides, previous to being submitted to this examination, must be fused on platinum foil with carbonate of soda. The bromides, however, exhibit the same reaction when thus treated.
Nitrates evolve colourless acid vapours of nitric acid. On adding to the mixture a small quantity of copper turnings, ruddy fumes of nitrous acid are given off.	- - The fusible nitrates detonate when heated with charcoal, cyanide of potassium, or phosphorus. When heated alone the alkaline nitrates disengage oxygen and nitrogen, while others yield nitrous acid and oxygen. They all evolve ruddy fumes of nitrous acid when heated with bisulphate of potash in a glass tube. A dry nitrate, heated with hydrochloric acid, dissolves gold leaf: this property is, however, possessed in common with chromates, chlorates, seleniates, bromates, &c.
Fluorides disengage dense pungent vapours of hydrofluoric acid, which change a piece of brazil-wood test-paper to straw colour; at the same time the glass tube becomes corroded, the hydrofluoric acid acting upon the silica of the glass with formation of fluoride of silicon and water.	- - The corrosion of the glass is best seen after washing and drying it. If the substance examined for fluorine contains silica the action on the glass will not be obtained; in this case fluoride of silicon is formed. On increasing the temperature the fluoride of silicon dissipates, and if brought in contact with water is decomposed, a gelatinous precipitate of silica subsiding, and hydrofluosilicic acid remaining in solution. When heated in an open glass tube with bisulphate of potash the glass immediately around the substance becomes corroded. In this examination the heat should be gradually applied to the mixture, as its too precipitate application is likely to shatter the tube, and consequently to spoil the experiment. Berzelius recommends the following process for the detection of fluorine:—The substance is mixed with metaphosphate of soda (which is obtained by heating microcosmic salt to redness), and introduced into one end of an open glass tube; the tube is now held in an inclined position, and the blowpipe flame urged in such a manner that a current of hot air is made to pass through the tube across the sample; when the vapours from the flame, carrying free hydrofluoric acid along with them, condense in the cool extremity of the tube, and are recognised by their peculiar corrosive action on the glass, as well as by their changing the colour of brazilwood test-paper.
Sulphurets evolve hydrosulphuric acid, known by its diffusing a disagreeable odour resembling that of rotten eggs. A solution of acetate of lead or nitrate of silver placed on a piece of card and exposed to the action of the gas becomes blackened. Sulphuretted hydrogen burns with a blue flame on being ignited, with the formation of sulphurous acid.	- - Alkaline sulphurets which contain a large amount of sulphur deposit an oily-looking substance (persulphuretted hydrogen) on the addition of an acid. Others, however, throw down a copious layer consisting only of sulphur. Heated in a glass tube open at both ends, they evolve sulphurous acid, which is easily known by its penetrating odour. When mixed with carbonate of soda heated in the reducing flame on charcoal, then placed in a clean silver spoon, and moistened with water, the sulphurets blacken the silver, sulphuret of silver being produced.
Sulphites emit the suffocating smell of burning sulphur.	- - Thrown into fused nitrate of potash, the sulphites are converted to sulphates, with evolution of red fumes of nitrous acid. They give the same reaction as the sulphurets (see above) when heated on charcoal with carbonate of soda. Heated alone to redness, the sulphites are converted to sulphurets and sulphates.

CHROMATES are reduced to green sulphate of chromium, oxygen gas, which accelerates the combustion of a burning substance, being evolved.	- - Heated with strong hydrochloric acid, chlorine, known by its odour and greenish-yellow colour, as also by its bleaching properties and power of dissolving gold leaf, is liberated. When a chloride (chloride of sodium) is mixed with a chromate, and heated in a test-tube with strong sulphuric acid, a red gas is disengaged, which condenses on cooling to a blood-red liquid.—(See further for detection of oxide of chromium, p. 27, vol. v., of *Chemical Times*.)
CARBONATES disengage an inodorous gas which extinguishes a burning splinter, and causes a milkiness, with formation of a white precipitate on standing, when passed into an alkaline solution of baryta or lime. Carbonic acid gas reddens moistened blue litmus-paper, which regains its blue colour after some time.	- - Most of the carbonates lose their acid when calcined; the alkaline carbonates, however, as well as those of strontia and baryta, fuse without decomposition. Heated strongly with charcoal powder, the alkaline carbonates evolve carbonic oxide gas, which burns with a blue flame. The presence of carbonic acid may likewise be ascertained by fusing a carbonate into a bead of borax, when a lively effervescence, owing to the escape of the gas, takes place. When carbon is thrown into fused nitre, carbonate of potash, which effervesces on the addition of an acid, is formed.

C.—*Compounds which do not Evolve any Gas when Heated with Sulphuric Acid.*

SULPHATES heated with carbonate of soda on charcoal in the reducing blowpipe flame are deoxidized, sulphuret of sodium, which is either of a brown or red colour, being formed. The sulphuret thus obtained, being placed upon a clean plate of silver, and moistened with water, leaves a black spot on the metal. As this reaction is exhibited by all the sulphur compounds, as well as by sulphur itself, no reliance can, of course, be placed on the result of this experiment taken singly; it is valuable, however, as a confirmatory test for the detection of the sulphates after the employment of the other blowpipe reagents; but the readiest and most decisive means of ascertaining the presence of a sulphate or sulphuric acid is the moist way, *i.e.*, by testing with a solution of chloride of barium, and demonstrating the insolubility of the precipitated sulphate in concentrated hydrochloric acid, a property which, being possessed by sulphate of baryta alone, at once precludes the necessity of applying any other test. Seleniate of baryta and silico-fluoride of barium are the compounds which by a resemblance of properties are most likely to be confounded with sulphate of baryta; the former, however, dissolves by being boiled with strong hydrochloric acid, with evolution of chlorine, and the latter is soluble both in concentrated nitric and hydrochloric acids. Testing in the moist way for the presence of sulphuric acid is the more requisite, too, as seleniates and selenites heated on charcoal with soda form a seleniuret of sodium, which, like the sulphurets, possesses the property of blackening metallic silver. Calcined with powdered charcoal, most of the dry sulphates emit sulphurous acid, known by its peculiar odour and reaction on brazil-wood paper; this reduction does not take place, however, either with the sulphates of the alkalis or alkaline earths.

BORATES give a green colour to the outer blowpipe flame when mixed with bisulphate of potash and fused on platinum wire. The phosphates similarly treated likewise afford a green colour. The same colour is also furnished with salts of copper and baryta before the blowpipe. A little attention to the different shades of the green colour soon enables the operator to avoid confounding them. For the detection of boracic acid in the borates the following method is recommended by Turner:—The borate, in a state of powder, is mixed with four and a half parts of bisulphate of potash and one of fluor spar; the mixture is then worked into a coherent mass with a little water, and fused in the inner flame on the platinum wire, when a green colour, occasioned by the liberation of fluoboric acid gas, is imparted to the exterior flame. If concentrated sulphuric acid is mixed with the solution of a borate, alcohol added, and the vapour ignited, a green colour is communicated to the burning flame. This is by far the most certain test for boracic acid; but solutions of chlorides when thus treated also yield a greenish-blue colour to the alcohol flame; it is easily distinguished, however, from the colour afforded by the borates.

PHOSPHATES, when heated on platinum wire with bisulphate of potash, or when dipped into concentrated sulphuric acid and heated before the blowpipe, communicate a bluish-green colour to the outer flame. When a phosphate is fused on charcoal with boracic acid, and a thin iron wire is thrust through the melted mass, and exposed for some time to the reducing flame, a fusible bead of phosphuret of iron is obtained, which, on cooling, is brittle, presenting a metallic appearance when broken, and is attractable by the magnet. In this experiment the phosphate loses its oxygen, borate of iron and the fusible bead of phosphuret of iron are formed, which latter, after cooling, possesses the properties above mentioned. A dry phosphate placed in a glass tube containing potassium, and heated, produces phosphuret of potassium. If metallic mercury is now poured into the tube, in order to dissolve out the excess of potassium employed, and the residue of phosphuret is moistened by being breathed upon, the characteristic odour of phosphuretted hydrogen gas is exhaled. The phosphites give with boracic acid and iron wire a reaction similar to that yielded by the phosphates. They are converted to phosphates when fused with nitre.

SELENIATES, heated with carbonate of soda on charcoal in the reducing flame, exhale a characteristic odour resembling that of putrid horseradish. The seleniuret of sodium which is formed, behaves towards a plate of metallic silver like the sulphurets.—(See Sulphates.) Seleniates give off chlorine gas when heated with concentrated hydrochloric acid, by which property they are distinguished from the sulphates. Heated in a closed tube in the dry state with chloride of ammonium or powdered charcoal, selenium accumulates in the cool part of the tube. Selenites behave with reagents like seleniates: they differ from them, however, in not disengaging chlorine when heated with hydrochloric acid.

IODATES are converted to iodides and oxygen gas when heated to redness; the residue of iodide may then be examined as directed under the iodides. They are distinguished from the iodides by their deflagrating when heated on charcoal, or, better, by their detonating when heated with cyanide of potassium, phosphorus, or sulphur. With concentrated sulphuric acid they are either converted to acid iodates, or separate iodic acid, which unites with the sulphuric acid, forming a white crystalline compound.

ARSENIATES and arsenites, when heated on charcoal with carbonate of soda, give off the characteristic odour of garlic. Mixed with charcoal or black flux, and heated to redness in a closed tube, they are reduced, a brilliant sublimate of metallic arsenic collecting in the upper part of the tube. The metal thus obtained when heated in a glass tube, open at both ends, is converted to white vapours of arsenious acid, while the characteristic garlic odour is at the same time exhaled. Solutions of arseniates are best distinguished from the arsenites by the colour of the precipitate thrown down by nitrate of silver: the arseniate of silver is brownish-red, the arsenite is yellow.

SILICIC ACID dissolves with effervescence to a clear glass when heated before the blowpipe with carbonate of soda. The soda should be added in small quantities at a time, or else on adding too much only an opaque glass is obtained. Silicic acid is the only substance which gives a clear bead when fused on charcoal with carbonate of soda, a property which distinguishes it from all other bodies. It dissolves slowly in borax, but with much greater difficulty in microcosmic salt. In the latter case the silica is seen to float about as an opaque mass, while its base is dissolved.

COAL MINES UNDER THE RIVER DEE.—There is a select committee of the House of Commons now sitting upon the management of the Crown property by the Commissioners of Woods and Forests. That board is now on its trial, and it is said some extraordinary disclosures have been made this session (the committee sits with closed doors), in addition to the body of evidence embodied in the report of the same committee during the session of 1848. It is rumoured that there are some curious disclosures made as to the encroachments and usurpations of two or three magnates upon the mines and minerals under the estuary of the Dee, in the counties of Flint and Chester, under colour of certain improvident grants from the Crown in the time of the Stuarts; but it is said that able lawyers put a widely different construction upon those grants, and it is now understood that the Crown has only to put in action its undoubted right to these valuable minerals (coals and ironstone), to get speedy possession of them. There will likewise be a large amount of back profits for somebody to refund, amounting to several hundred thousand pounds. The commissioners are now prompt as they were before tardy in asserting the Crown rights, as a precisely analogous case, "The Attorney-General against Rees and others," where the coals under the estuary of the river Bury, in Glamorganshire, are claimed by the Crown from Lord Cawdor and his lessees, is in full progress before the Master of the Rolls. —*Chester Courant.*

ROYAL COLLEGE OF SURGEONS.—The following gentlemen, having undergone the necessary examination for the diploma, were admitted members of the college at the meeting of the Court of Examiners on the 16th inst.:—Messrs. John Albert Morris, St. James's-place; John Evelyn Crook, Northfleet, Kent; George Hymenæus Lovegrove, Gloucester; Thomas Arthur Finnimore, Harrow-road; William Bradley, Preston, Lancashire; James William King, Dublin; Frederick Le Keux, London; and Philip William Govett, Plymouth.

Evan Leigh, of Ashton-under-Lyne, cotton-spinner, for certain improvements in steam-engines; and also improvements in communicating steam or other power for driving machinery. Patent dated July 18th, 1849; six months.

STATEMENT IN CONTINUATION OF THE ONE PUBLISHED IN THE CHEMICAL TIMES OF JULY 21, 1849, SHOWING THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE AIR FROM JULY 15 TO 21 INCLUSIVE, AS INDICATED BY THE EVAPORATION OF WATER FROM TWO COPPER VESSELS OR SCALES, ONE INSULATED AND THE OTHER NOT. ALSO THE READING OF THE BAROMETER, THERMOMETER, DIRECTION OF WIND, AND GENERAL STATE OF THE WEATHER.

July, 1849.	Barometer.		Therm.		Scales.				Wind.		General state of weather.
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Insulated	Non-Insulated	Morning.	Evening.	
15	30.14	30.15	65	65	..	20 N.	..	20	NE.	NE.	Cloudy and overcast till three o'clock. Fine rest of day.
16	30.12	30.00	65	67	..	10 N.	..	10	NE.	SW.	White clouds, with black ones underneath, all day. Fine evening.
17	29.88	29.73	70	63	10 I.	..	10	..	SW.	SW.	Fine till ten o'clock. Overeast and rain nearly all the remainder of the day and evening.
18	29.71	29.65	64	59	..	20 I.	20	..	SW.	SW.	Heavy showers and sunshine all day. White clouds under the black. Fine evening.
19	29.57	29.55	60	56	15 N.	15 I.	15	15	W.	SW.	Cloudy till noon. Thunderstorm and heavy showers rest of day. Fine evening
20	29.52	29.70	65	58	..	15 N.	..	15	NW.	SW.	Heavy showers all day.
21	29.80	30.00	59	61	10 I.	..	10	..	NW.	NW.	Overcast and little rain morning. Fine rest of day.

The forebodings of last week's table, in reference to health, were anything but encouraging. On that subject I was, therefore, silent. This week the numbers are 55 to 60; and, although the insulation is low, still there is nothing to alarm,—an observation that may be applied to the electric condition of all this month, except on the days of the 11th, 12th, 13th, 14th, and 15th. Is not, then, the present epidemic referable to the influence of the very low electric condition of the air or high state of the earth of April, May, and June, and to which I requested Mr. Chadwick's attention in the middle of May? And of the electric condition of other parts of the metropolis, in comparison to that of this neighbourhood, we are in the dark.

Westminster-road, July 23, 1849. Franklin Coxworthy, Author of "Electrical Condition," &c.

ORIGINAL COMMUNICATIONS TRANSLATIONS, ETC.

ON THE ESTIMATION OF PHOSPHORIC ACID, AND ON ITS SEPARATION FROM BASES.

By HENRY ROSE.

As is well known, the quantitative investigation of the compounds containing phosphoric acid is one of the most difficult problems of analytical chemistry. The difficulties increase with the number of bases with which the acid is combined; for the different phosphates, even when they all contain the same modification of the acid, the *c*-phosphoric acid, frequently behave very differently towards the same reagents, and are not all decomposed in the same manner when treated with one and the same decomposing agent.

The behaviour of the *a* and *b* phosphoric acids towards reagents differs in many cases so much from that of the ordinary phosphoric acid that it is frequently necessary to employ other methods for their separation than for the estimation of the latter. It is, however, in most cases advantageous to convert those modifications into the ordinary phosphoric acid, which considerably facilitates the estimation of the acid.

It is especially in the investigation of the ashes of organic substances, which always contain phosphoric acid, often forming the most important constituent, that we meet difficulties in the estimation of this acid. Frequently the quantitative analyses of these ashes are so complicated that their results, even though they have been obtained by chemists of high reputation, are not at all to be depended upon. The principal cause of these difficulties is undoubtedly owing to the circumstance that we are acquainted with no method by which we are able to separate the phosphoric acid in a substance having a very complex composition in such a manner that after its separation the other constituents may easily and accurately be estimated, as is the case, for instance, after separating sulphuric or hydrochloric acids, however large the number of bases or even of acids they may have been combined with. My principal object, therefore, in commencing this investigation was to discover some method by which the phosphoric acid might be so separated from mixtures of phosphates containing either modification of the acid, that not only its amount could be determined with the greatest accuracy, but that after its separation the bases might be readily examined and estimated without being contaminated by the reagent used to separate the phosphoric acid. I shall first briefly discuss the methods hitherto employed for the separation of phosphoric acid from bases, and comment upon their accuracy, and then proceed to describe the one I propose for this purpose.

ESTIMATION OF PHOSPHORIC ACID.

When phosphoric acid is contained alone in solution its amount may be best determined by evaporating the solution with a weighed quantity of recently-calcined oxide of lead, and igniting the dry mass. The solution must contain no bases, and only such acids besides phosphoric acid as are completely expelled by heat from the oxide of lead, as nitric acid and others.

When phosphoric acid is contained in a liquid along with fixed or volatile bases and several other acids it is usual to estimate it by precipitating it in the form of ammonio-phosphate of magnesia. In this operation far more precaution is requisite than when magnesia is separated by phosphate of soda and ammonia in the form of ammonio-phosphate of magnesia. It is above all things necessary that the acid is contained in the solution as *c*-phosphoric acid, for this only can be separated completely as ammonio-phosphate of magnesia. Moreover, when sulphate of magnesia, ammonia, and a sufficient quantity of chloride of ammonium (to dissolve the hydrate of magnesia) have been added to the solution, it must not be heated strongly, much less boiled, otherwise a precipitate of hydrate of magnesia may result, but only warmed to 86°, and filtered after some hours. It is well known that the salt must not be washed with pure, but with water containing ammonia. The presence of a large amount of ammoniacal or other salts has no influence on the precipitation of the ammonio-phospate of magnesia. M. Weber has shown how the *a* and *b* phosphoric acids may be converted into the *c* modification.*

When phosphoric acid is precipitated from a liquid as ammonio-phosphate of magnesia, it will not do to neutralize with carbonate of ammonia instead of with pure ammonia, for then ammonio-carbonate of magnesia is slowly deposited, frequently coating the sides of the glass in stellate groups of crystals. It may frequently contain no phosphoric acid, which only separates as ammonio-phosphate of magnesia on the addition of a certain amount of caustic ammonia.†

SEPARATION OF BASES FROM PHOSPHORIC ACID BY SULPHURET OF AMMONIUM.

Those metallic oxides which are converted in their solutions or in the recently-precipitated state by sulphuret of ammonium into sulphurets insoluble in an excess of the sulphuret of ammonium are frequently separated by this reagent from phosphoric acid. When the mixture of the phosphates contains, besides such metallic oxides, magnesia or alkaline earths, these are precipitated as phosphates along with the sulphurets, on which account this method is only employed in the absence of these bases; but even in this case it is not frequently used, and mostly only in qualitative examinations, where it is often of advantage. Very frequently peroxide of iron is among the bases; and this, as is well known, is the most difficult of the sulphurets to separate.

To ascertain whether the peroxide of iron is wholly converted by sulphuret of ammonium into sulphuret of iron, and contains no residue of phosphoric acid, some basic phosphate of iron, Fe_2O_3, PO_5, was dissolved in muriatic acid, the solution supersaturated with ammonia, and then mixed with sulphuret of ammonium; the precipitate was set aside for twenty-four hours, filtered, and then converted in the usual manner into peroxide of iron. The liquid filtered from the sulphuret of iron was precipitated as ammonio-phosphate of magnesia, without previously destroying the sulphuret of ammonium. M. Weber obtained in this way, in two analyses, the following results:—

	I.	II.	Calculated.
Peroxide of iron....	49.31	51.47	52.31
Phosphoric acid. ...	50.00	50.61	47.69
	99.31	102.08	100.00

It is evident from these experiments how difficult it is to separate the peroxide of iron from phosphoric acid by converting it into sulphuret. The sulphuret of iron proved on examination to be free from phosphoric acid, but the calcined phosphate of magnesia contained iron; on solution in muriatic acid it gave out an odour of sulphuretted hydrogen; furnished with ammonia

* Vide *Chemical Times*, vol. iv., p. 352 sqq. ("On the Isomeric Modifications of Phosphoric Acid").

† Different views prevail with regard to the composition of the salt which separates on adding a solution of carbonate of ammonia to a solution of sulphate of magnesia mixed with chloride of ammonium. M. Weber found it to consist in 100 parts—of magnesia, 21.35; ammonia, 7.07; carbonic acid, 30.15; and water, 41.43. This would agree best with the very complicated formula $5MgO\ CO_2 + 2NH_3\ CO_2 + 21HO$. The subject, however, deserves a more careful examination.

and sulphuret of ammonium a grey precipitate; a blue colour with ferrocyanide of potassium; a red one with the sulphocyanide.

The result of this experiment will appear surprising, it being generally considered that metallic oxides are separated by no reagents so perfectly as by sulphuretted hydrogen or sulphuret of ammonium. It seemed probable that a better result might be obtained by converting the peroxide of iron in the phosphate into sulphuret in the dry way; such, however, is not the case, as shown by the following experiment made by M. Weber. Some phosphate of iron, Fe_2O_3, PO_5, was mixed with three times the amount of carbonate of soda and sulphur, and heated in a small porcelain crucible: it was not possible to fuse it with the strongest heat of an Argand lamp. On cooling, the mass, which had caked together, was treated with hot water, and the sulphuret of iron collected on a filter; the greater portion of it had a perfectly crystalline appearance, and pertinaciously resisted the action of muriatic acid; it must, therefore, have been a higher sulphuret, possessing, probably, the same composition as iron pyrites. Notwithstanding its crystalline structure, it could not be washed with pure water nor with dilute sulphuretted hydrogen, for the filtered water was of a greenish colour; it was requisite to employ water to which some sulphuret of ammonium had been added. On account of its insolubility in muriatic acid it was calcined with access of air, then dissolved in muriatic acid, and the peroxide of iron precipitated by ammonia: it proved to be perfectly free from phosphoric acid. The acid was precipitated in the usual way as ammonio-phosphate of magnesia; the following are the results:—

	I.	II.
Peroxide of iron	49.67	49.22
Phosphoric acid	48.85	46.83
	98.52	96.05

The sulphuret of iron is the most difficult of all to separate from a phosphatic liquid. With the other sulphurets this is far less the case.

SEPARATION OF PHOSPHORIC ACID BY PEROXIDE OF IRON ACCORDING TO BERTHIER'S METHOD.

This well-known method is frequently employed in quantitative investigations. It is founded on the circumstance that phosphoric acid, in combination with peroxide of iron, may be entirely precipitated by ammonia, but only when the oxide is present in a very large excess. Several experiments were made to ascertain what amount of peroxide of iron must be present in proportion to that of the phosphoric acid for the whole to be precipitated by ammonia. Berthier states that for two parts of phosphoric acid the peroxide of iron from one part of metallic iron is requisite. When too little of the solution of peroxide of iron is added to the liquid, so that no basic phosphate of iron can be formed, the perphosphate of iron is dissolved by the ammonia.

It is also of moment whether the acid is to be precipitated by the peroxide of iron as pyrophosphoric or as ordinary phosphoric acid. If, for instance, a solution of the pernitrate of iron is added to a solution of crystallized phosphate of soda, the weight of metallic iron being twice that of the phosphoric acid, and the mixture be then saturated with ammonia, the filtered liquid has a yellow colour. If as much peroxide of iron again be added, and the whole supersaturated with ammonia, the filtered liquid is, it is true, nearly colourless; but sulphuret of ammonium produces a green colour in the course of half an hour, if not immediately, and subsequently black flakes of sulphuret of iron are deposited. Moreover, when the precipitate is washed with cold water it soon begins to pass yellow through the filter; and this occurs in a higher degree when ammoniacal water is employed; it then passes through with a perfectly dark red colour.

When the solution contains pyrophosphoric acid, a much larger amount of peroxide of iron is requisite to separate the acid—frequently eight to ten times the quantity prescribed by Berthier. We then finally obtain a liquid which when filtered from the very bulky precipitate is clear and colourless, but on washing the precipitate the water passes through coloured frequently dark red. When boiling water is used, it passes through the filter perfectly clear at first; but as soon as it begins to cool upon the precipitate it acquires a yellow, and finally a dark red, colour.

When the solution of pernitrate of iron is added to a solution of the pyrophosphate of soda, a white precipitate is produced (even when the solution of iron contains much free nitric acid), which does not really dissolve on the addition of a larger quantity of nitric acid; but it is soluble in hydrochloric acid. On supersaturating with ammonia, a perfectly transparent red solution is formed when no more peroxide of iron has been employed than directed by Berthier. It is only on the addition of a much larger amount of peroxide of iron that a brownish-red precipitate is produced by ammonia. On the addition of a solution of nitrate of iron containing free nitric acid to a solution of a *c*-phosphate, no precipitate is produced until after supersaturation with ammonia.

It is evident from these experiments that Berthier's method cannot be employed in accurate investigations; it may, however, sometimes be of use in qualitative experiments.

Von Kobell has ingeniously modified Berthier's method. Whilst, according to the method of Berthier (even were it capable of affording a correct result), the phosphoric acid can only be separated from a liquid containing sulphuric, nitric, or hydrochloric acid, and alkalis, but no other bases, it can be separated by Kobell's plan from magnesia and from all those metallic oxides which belong to the strong bases, and are not precipitated in the cold by carbonate of baryta. This method consists in dissolving the phosphatic compound in hydrochloric acid, adding to it a solution of the peroxide of iron, and mixing the whole in the cold with an excess of carbonate of baryta instead of with ammonia; the whole of the phosphoric acid combined with peroxide of iron is precipitated by the carbonated earth, whilst the metallic oxide is held in solution combined with hydrochloric acid. Von Kobell recommends carbonate of lime; carbonate of baryta, however, is preferable.

When the amount of peroxide of iron added is known, it is merely requisite to dissolve the washed and gently-calcined precipitate, and to precipitate the baryta from the solution by sulphuric acid, in order to calculate from the weight of the sulphate of baryta the amount of carbonate of baryta, which will then furnish the amount of phosphoric acid. The baryta dissolved in the liquid separated from the precipitate is removed by sulphuric acid, and the amount of base which had been combined with the phosphoric acid determined.

This method furnishes satisfactory results. 1.965 grm. calcined phosphate of magnesia was dissolved in hydrochloric acid, and to it was added a solution of 1.284 grm. metallic iron in nitromuriatic acid, and then an excess of carbonate of baryta. A very slight precipitate is produced with concentrated solutions, but on dilution with water a bulky light brown precipitate is deposited. The filtered liquid, freed from baryta by sulphuric acid, furnished with phosphate of soda and ammonia 2.005 grms. calcined phosphate of magnesia. A small excess, therefore, was obtained; it consisted of peroxide of iron, which had not been entirely removed by the carbonate of baryta. The solution of the calcined precipitate gave a grey precipitate with ammonia and sulphuret of ammonium; but the presence of iron was still more distinctly indicated by sulphocyanide of potassium.

As the precipitate produced by carbonate of baryta is very bulky, Von Kobell proposes, when the object is a mere separation, to treat the phosphate, if the base is insoluble in a solution of hydrate of potash, previously with this reagent, in order to remove the greater portion of the phosphoric acid. Only a very small quantity of solution of iron need then be added to the compound treated with potash, and the precipitate is less bulky.

SEPARATION OF PHOSPHORIC ACID BY CARBONATE OF BARYTA.

As the separation of phosphoric acid according to Kobell's method succeeded tolerably well, I attempted to separate the strong bases from phosphoric acid by carbonate of baryta without any addition of solution of iron: I did not expect to succeed, as phosphoric acid is not perfectly precipitated from its aqueous solution by carbonate of baryta; the result, however, was favourable beyond all expectation. 1.229 grm. calcined phosphate of magnesia was dissolved in muriatic acid, the solution left in contact with carbonate of baryta for a long time at the ordinary temperature, filtered, and washed with cold water. The precipitate dissolved in muriatic acid gave, after removing the baryta with sulphuric acid, on the addition of sulphate of magnesia, chloride of ammonium, and ammonia, 1.216 grm. calcined phosphate of magnesia. The liquid separated from the precipitate, after removing the baryta by sulphuric acid, furnished, on precipitation with phosphate of soda and ammonia, 1.290 grm. calcined phosphate of magnesia.

Both the quantities of the calcined phosphate of magnesia obtained in the analysis should be equal, and likewise agree with the quantity taken for analysis. They do not, however, differ very considerably. The loss in phosphoric acid was owing to the acid of the pyrophosphate of magnesia employed not being entirely converted into *c*-phosphoric acid by solution in muriatic acid. The results were:—

	Found.	Calculated.
Magnesia	36.95	36.61
Phosphoric acid.....	62.49	63.39

SEPARATION OF PHOSPHORIC ACID BY FUSING PHOSPHATIC COMPOUNDS WITH CARBONATED ALKALI.

A large number of phosphates are completely decomposed by fusion with carbonated alkali. On treating the fused mass with water, only the excess of carbonate and the phosphated alkali are dissolved, when the bases combined with the phosphoric acid are insoluble in the solution of the carbonated alkali. Precisely those phosphates which most frequently occur in investigations, especially in the examination of the ashes of organic substances, are not completely decomposed by fusion with carbonated alkali; these are the combinations of phosphoric acid with the alkaline earths, and especially the phosphate of lime. I have frequently fused this salt with carbonate of potash as well as with carbonate of soda, and with a mixture of the two, but have never effected a complete decomposition, however varied the proportions and the degree of heat. The amount of decomposed phosphate of lime differed considerably in the several experiments; sometimes the residue of the fused mass, insoluble in water, only contained a very little carbonate of lime.

Nor can the phosphate of lime be perfectly decomposed by treatment with a solution of carbonate of soda. When it is treated with a concentrated solution of a carbonated alkali in the cold in the non-calcined state, the decomposition is nearly perfect. When the insoluble portion is well washed, but a slight precipitate of phosphate of lime is produced in the muriatic solution by ammonia. A solution of phosphate of soda consequently exerts no action in the cold upon carbonate of lime. When, on the other hand, calcined phosphate of lime is treated with a solution of carbonate of soda, the decomposition is imperfect; 1.455 grm. ignited phosphate of lime, $2CaO$, PO_5, boiled several hours with a solution of carbonate of soda, was dissolved after perfect washing in dilute muriatic acid. The solution furnished, on saturation with ammonia, 0.620 grm. phosphate of lime; consequently, 42.61 per cent. of the phosphate of lime had not been decomposed by boiling with carbonate of soda. When, however, cal-

cined phosphate of lime is treated in the cold with a solution of carbonate of soda, scarcely any decomposition occurs. When filtered after seven days the liquid, supersaturated with muriatic acid and mixed with sulphate of magnesia, chloride of ammonium, and ammonia, exhibited scarcely any perceptible turbidness.

When phosphate of lime is fused in a silver crucible with hydrate of potash, it dissolves entirely on ignition to a clear liquid; but on treating the fused mass with water nearly the whole of the phosphate of lime is left undissolved; and on supersaturating the filtered liquid with an acid, then mixing it with sulphate of magnesia, chloride of ammonium, and ammonia, a very slight precipitate of ammonio-phosphate of magnesia is obtained.

Phosphate of strontia, when fused with carbonate of soda, is partially but not entirely decomposed. When the fused mass is treated with water the liquid gives but a slight precipitate on supersaturation with muriatic acid, and the addition of sulphate of magnesia, chloride of ammonium, and ammonia.

Phosphate of baryta, on the contrary, is decomposed to a far greater extent, although not completely. It fuses with six times its weight of carbonate of soda. When treated with water, the insoluble and washed residue dissolves with great effervescence in muriatic acid; the solution gives with ammonia only a slight precipitate of phosphate of baryta.

Phosphate of magnesia requires six times its weight of carbonate of soda to fuse the mass. In this case the decomposition is nearly complete; and, according to several experiments, not more than from two to three per cent. of phosphate of magnesia remain undecomposed. According to Heintz, perfect decomposition obtains when the fusion is effected in a blast-furnace.

When a mixture of carbonate of potash and soda in equivalent proportions is used for the decomposition of the phosphate of magnesia, the mixture fuses with the greatest ease, and the decomposition is, according to M. Weber, complete. It is, however, impossible to effect by means of this mixture a perfect decomposition of the phosphates of baryta, strontia, and lime. In this, as in the previous instance, the phosphate of lime least of all.

Phosphate of zinc is completely decomposed with carbonate of soda; the mass, treated with water and filtered, furnishes a liquid in which no oxide of zinc can be detected by sulphuret of ammonium. The insoluble oxide of zinc was also free from phosphoric acid.

Phosphate of the protoxide of manganese is likewise completely decomposed by fusion with carbonate of soda. A brown residue is obtained on treating the fused mass with water which contains much sesquioxide of manganese, and after being well washed furnishes a very dark brown solution with muriatic acid, which is rendered colourless by boiling. Ammonia produces a white precipitate, which is soluble in a large amount of chloride of ammonium, in which solution sulphate of magnesia produces no precipitate. Sulphuret of ammonium produces no precipitate of sulphuret of manganese in the liquid filtered from the insoluble residue.

Phosphate of copper is partially reduced on fusion with carbonate of soda to protoxide of copper; the insoluble residue left on treatment with water disengages deutoxide of nitrogen on solution in nitric acid. The acid solution, supersaturated with ammonia, is not rendered turbid by sulphate of magnesia and chloride of ammonium; the liquid filtered from the insoluble residue, after being rendered acid with nitric acid, furnished on supersaturation with ammonia a slight turbidness, and exhibited a faint bluish tint. We know that oxide of copper cannot be entirely precipitated by carbonated alkali even in the moist way.

Phosphate of the peroxide of iron is completely decomposed by fusion with carbonate of soda. When the fused mass is treated with water, the washed peroxide of iron contains not a trace of phosphoric acid; for on solution in muriatic acid not the slightest precipitate is produced on the addition of tartaric acid, chloride of ammonium, sulphate of magnesia, and ammonia.

1.764 grm. perphosphate of iron, $Fe_2 O_3$, PO_5, fused with four times its weight of carbonate of soda, gave, on treating the fused mass with water, 0.938 grm. peroxide of iron, which, dissolved in muriatic acid and precipitated from the solution with ammonia, weighed only 0.923. The liquid separated from the peroxide of iron, rendered acid, then saturated with ammonia, and mixed with sulphate of magnesia and chloride of ammonium, gave 1.320 grm. calcined phosphate of magnesia. There was obtained, therefore, in 100 parts:—

	Found.	Calculated according to $Fe_2 O_3$, PO_5.
Peroxide of iron	52.32	52.31
Phosphoric acid	47.78	47.69

The result is very accurate, and the method of decomposing the phosphate of iron by fusion with carbonate of soda far preferable to treating the solution in acids with sulphuret of ammonium.

Although it is evident from the above experiments that several phosphates, especially those of the true metallic oxides, may be entirely decomposed by fusion with carbonated alkali; others, on the contrary, are only partially decomposed. When, consequently, we have a mixture of phosphates to examine, and wish to separate the phosphoric acid from the bases, in order to examine the latter without the fear of their retaining more or less phosphoric acid, the fusion with carbonated alkali is not adapted. If alkalis were contained among the bases they could not be determined.

But since phosphoric acid can be easily and perfectly separated by fusion with carbonate of soda from those metallic oxides which are insoluble in alkaline carbonates, this method was also tried in the separation of phosphoric acid from those metallic oxides and acids which dissolve in alkaline carbonates, but are converted by reduction into oxides which are insoluble in it. The most favourable results were obtained.

SEPARATION OF PHOSPHORIC ACID FROM OXIDE OF URANIUM.

When phosphate of the oxide of uranium is fused with carbonated alkali the result is not trustworthy, especially when a considerable excess of the carbonate has been used, as on treating the fused mass with water some oxide of uranium is always dissolved with the phosphate and carbonated alkali. Perfect decomposition is not effected by boiling with concentrated solution of potash.

In the methods recently described by M. Werther there is always the danger of destroying the platinum crucible. The following plan of separating phosphoric acid from oxide of uranium is far more simple:—The compound is mixed with three times its weight of carbonate of soda and as much cyanide of potassium, and the whole fused in a platinum crucible. At first a very moderate heat must be applied, as the mass froths considerably and shows an inclination to overflow. However, this ceases after a little time, when a stronger heat is applied until the whole is fused to a clear liquid mass. Whilst the whole is liquid a small piece of cyanide of potassium is placed upon it, the lamp immediately removed, and the crucible covered. On adding the cyanide of potassium, the lid should be held close over the crucible, to prevent any loss from ejection. On cooling, the crucible is placed in a beaker, digested with hot water until the mass is softened, and the insoluble portion allowed to subside. It is advisable to add some chloride of ammonium to the liquid, as this causes the suspended protoxide of uranium to subside, and prevents the liquid from passing turbid through the filter. The protoxide of uranium is washed with water containing a little chloride of ammonium.

The dried protoxide of uranium easily becomes yellow on ignition, even in a covered crucible, which is owing to its containing some alkali; but when it is calcined in an atmosphere of hydrogen it is obtained of constant weight. However, since it contains alkali, it must be dissolved in nitric acid; the oxide of uranium precipitated with ammonia, and washed with water to which a few drops of chloride of ammonium have been added. When calcined after drying in an atmosphere of hydrogen, less protoxide of uranium is obtained than previously; and in the liquid filtered from the precipitate minute quantities of the alkali can be detected.

The liquid filtered from the protoxide of uranium, which contains besides the whole amount of phosphate, carbonate of soda, and cyanide of potassium, is supersaturated with hydrochloric acid, and the phosphoric acid precipitated as ammonio-phosphate of magnesia.

This method furnishes very accurate results, as will be seen by the following experiment:—1.085 grm. protoperoxide of uranium (UO + $U_2 O_3$), corresponding to 1.042 UO, was mixed with 0.714 calcined phosphate of soda, which contains 0.381 phosphoric acid; the mixture contained, therefore, 57.90 per cent. UO and 21.19 PO_5. There was obtained 1.071 grm. or 59.56 per cent. UO, which, however, by solution in nitric acid and precipitating the oxide of uranium as above described, was diminished to 1.039 grm. (= 57.78 per cent.); the amount of calcined phosphate of magnesia obtained was 0.608 grm., corresponding to 0.359 grm. phosphoric acid, or 20.00 per cent.

SEPARATION OF PHOSPHORIC ACID FROM CHROMIC ACID.

Earlier experiments on the separation of these two acids, in which the chromic acid was reduced to oxide of chromium, which can then be separated by fusion with carbonate of soda from the phosphoric acid, did not furnish perfectly accurate results, because it is difficult to reduce the last traces of chromic acid to the state of oxide. The method employed for separating the oxide of uranium from phosphoric acid by means of cyanide of potassium was employed with advantage.

0.957 chromate of potash and 0.451 phosphate of soda, mixed with three times the quantity of carbonate of soda and cyanide of potassium, was fused; the fused mass, treated with water, furnished a green insoluble oxide of chromium. For the better separation of the oxide of chromium, the perfectly colourless liquid was mixed with chloride of ammonium, with a weak solution of which the oxide was washed. The filtered liquid, carefully supersaturated with muriatic acid, then mixed with ammonia, sulphate of magnesia, and chloride of ammonium, furnished ammonio-phosphate of magnesia, which weighed on ignition 0.375 grm., corresponding to 16.90 phosphoric acid in the mixture, which contained according to theory 17.47. The calcined oxide of chromium weighed 0.401 grm., which corresponds to 37.85 per cent. chromic acid, whilst the calculated quantity is only 35.01 per cent. It evidently contained alkali.

To ascertain this the calcined oxide of chromium was digested and heated with concentrated sulphuric acid, in which, as is well known, it does not dissolve, at all events not to any extent, whilst on dilution with water the insoluble oxide assumes a very flocculent and bulky consistence, so that it appeared probable it might be separated in a pure state by treatment with ammonia and a gentle heat; but the oxide weighed after ignition and after treatment with carbonate of ammonia 0.401 grm., or just as much as before treatment with sulphuric acid. It was, therefore, fused with a mixture of carbonate and nitrate of alkali, the fused mass dissolved in water, the solution neutralized with nitric acid, and the chromic acid precipitated as chromate of the protoxide of mercury, which left on calcination only 0.375 oxide of chromium, corresponding to 34.51 per cent. chromic acid. This is half a per cent. less than theory requires; and it will not appear remarkable, considering how

many operations the oxide of chromium had to be submitted to, to convert it into pure oxide. The presence of the alkali could be detected in the liquid separated from the protochromate of mercury.

The separation of phosphoric acid from chromic acid might certainly be most easily effected by precipitating the phosphoric acid from the solution as ammonio-phosphate of magnesia; but then it is difficult to separate the chromic acid from the magnesia; it is best accomplished by the protonitrate of mercury, on which account the method of fusion with carbonate of soda and cyanide of potassium is preferable.

[*To be continued.*]

ON GLAIRINE, GLAIRIDINE, AND ZOÏODINE.

By M. BONJEAN.

GLAIRINE.

This substance is a vegeto-animal matter produced at the sulphurous spring of Aix, in Savoy. According to M. Duby, who has examined it microscopically, it consists of extremely minute fragments of a plant, of an extraordinarily fine, close, undulating tissue, which is insoluble in water, and has the appearance of an animal remain.

Glairine is produced by the immediate action of the air on the sulphurous water, and is deposited on the pavement of the pumps. It retains a large quantity of water, which it does not lose by long exposure to the air: it is not entirely expelled below 104° F. Thus dried it is quite colourless, completely inodorous, of a horny appearance, and is reduced to about one tenth of its weight; when water is added to it, it is rendered again mucilaginous, becomes nearly of its original size, but remains inodorous. When dried and thrown upon burning charcoal it gives the smell of burnt horn, without any trace of sulphurous acid, and the gases which it yields turn reddened litmus-paper blue. The absence, in this experiment, of sulphurous acid seems to indicate that this substance contains no sulphur; it will soon be shown that it contains so little that it can only be isolated by means of ether. Water, alcohol, oil of turpentine, nitric, hydrochloric, sulphuric, phosphoric, oxalic, acetic acids, &c., solution of chlorine, dilute alkalis, all dissolve a small quantity cold, and a little more when heated, but some of them occasion peculiar modifications in it. The nitric, concentrated hydrochloric acid, and liquid chlorine, immediately destroy the grey colour which it acquires out of water and restore its natural whiteness. Separated from these acids, it becomes more grey by exposure to the air: other acids do not decolorize it. Alkalis precipitate it from solution in acids in white flocculi which have a bluish reflection. The nitric solution, filtered and evaporated to dryness in a small porcelain capsule, leaves a yellowish sharp residue, which is slightly acid, difficultly decomposable in a strong heat, and insoluble in water and in alcohol: glairine does not decompose nitric acid unless it be heated. When hydrochloric acid decolorizes glairine blackened by contact with the air, it assumes a yellow colour, derived from the formation of a persalt of iron. This shows that this organic matter contains peroxide of iron in combination, derived, unquestionably, from the carbonate of iron which the water holds in solution. Concentrated sulphuric acid, instead of decolorizing it, like the forementioned acids, imparts to it the colour of wine dregs, which becomes lighter when acidulated water is added. The caustic alkalis do not act upon it when cold; but when heated a green colour results, which acids cause to disappear immediately. Bromine also decolorizes it; but at first it gives it a red colour, and the decoloration of the glairine is not perfect until all the bromine is volatilized. If it should retain a yellow tint from some remaining bromine, washing with distilled water renders it perfectly white. Iodine colours it brick-red; and this colour does not disappear either by long exposure to the air or frequent washings. Alcohol and oil of turpentine dissolve a small quantity, and acquire a slight yellow tint; alcohol becomes sweetish, and its consistency is sensibly increased. If these two liquids be evaporated to dryness in a porcelain capsule, the lower portion is carbonized by slightly increasing the heat.

Glairine is totally insoluble in ether. If they be mixed in a well-stopped phial, and shaken occasionally during two or three days, the ether when filtered leaves by evaporation small rounded grains of perfectly pure sulphur; they are yellow and brilliant, of the size of a pin's head, and when thrown on a burning coal burn with a fine blue flame and the disengagement of sulphurous acid.

When glairine is gradually heated on a platinum crucible it loses its interposed water slowly, and even begins to be decomposed before it has parted with the whole of it; towards the end of the calcination it exhales the odour of burnt horn, without any sensible disengagement of sulphurous acid, and leaves a coaly residue. It does not fuse, and it is difficult to incinerate it; it does not lose its odour by numerous washings with cold water, but imparts a very distinct one to it, with a sweetish taste, without giving it colour; long boiling takes away the greater part of it; the solution has a strong smell, and the residue is very small. This liquor when filtered is yellowish, has a sweetish animal taste, is not mucilaginous, and does not coagulate on cooling; when evaporated to a syrupy consistence in a porcelain capsule, it colours the sides of it strongly yellow. The residue is of a deep yellow, with a slight smell and bitterness; the sulphuric and nitric acids, whether concentrated or diluted, do not sensibly act upon it. When glairine is subjected to dry distillation in a glass retort placed in a reverberatory furnace, it swells at first, and boils in the water which it retains interposed. This water soon begins to distil by drops, is colourless, has a strong smell of animal matter, and the apparatus is filled with vapours. The odour of burnt horn soon replaces that of animal matter, and drops of a yellow colour then fall into the receiver. Lastly, when the heat becomes very strong, the retort contains charcoal, and the neck is covered with a black substance, of which a few drops only fall into the receiver with the yellow liquor, and immediately solidify. The yellow distilled liquor has a strong burnt odour and taste, with slight bitterness. It reddens litmus feebly, and dissolves in all proportions in water and alcohol. Ether does not dissolve it, but separates a small quantity of yellow fatty matter, which it leaves by evaporation; it is insoluble in water, but very soluble in alcohol.

The coaly residue of the distillation treated with distilled water yielded a slightly alkaline solution; during distillation the gases disengaged restored the blue colour of reddened litmus. The dry residue of the distillation was a very light, black, and friable charcoal, which yielded 0.75 of ash composed of silica, carbonate of lime, and peroxide of iron. No trace of iodine could be detected.

The preceding experiments on glairine lead to the following conclusions:—It contains very little nitrogen and no iodine; it dissolves sparingly in water, alcohol, oil of turpentine, and rather more readily in concentrated acids, from which the alkalis precipitate it in bluish-white flocculi; heat in all cases increases the solvent power of the liquids; it is quite insoluble in ether, which isolates perfectly the small quantity of sulphur which it retains interposed between its molecules; it becomes rapidly of a more or less blackish-grey colour when taken from the water and exposed to the air; but it is sufficient to treat it with nitric or hydrochloric acid, bromine or chlorine, to restore its natural whiteness: sulphuric acid, far from decolorizing it, imparts to it the colour of wine-lees; the concentrated alkalis render it green when heated, and the alkalis destroy it; when in water it has but very little odour; but as soon as taken from it it acquires a most disgusting smell, which is not dissipated by long exposure to the air, at least while it retains a little water; nor is it got rid of by much washing with cold water, or by long boiling, although in the latter case the greater part of it disappears. Lastly, it becomes perfectly inodorous by thorough drying in a stove, assumes a horny appearance, and is reduced to about one tenth of its weight.

GLAIRIDINE.

The author observed that, when the sulphurous waters above described become mixed with rain-water, another vegeto-animal matter appears, to which he has given the name of *glairidine*.

The principal characters of this substance are, that it is of a deep grey colour, instead of being colourless, like glairine; it is inodorous, and remains so even when exposed to the air. Long exposure to the air does not alter its colour; but if a glass bottle be immediately filled with it it soon acquires a smell, which in a few days becomes as disagreeable as that of glairine taken from water. If it then be taken from the bottle and exposed to the air, it becomes quite inodorous, and dries perfectly in a few days; on the contrary, it has been shown that glairine does not lose its interposed water till exposed to a heated stove. Glairidine is not decolorized either by any acid or by liquid chlorine. Like glairine, it renders hydrochloric acid yellow on account of the peroxide of iron which it contains. Water, alcohol, oil of turpentine, and the acids, dissolve a small quantity of it; it is insoluble in ether; it separates sulphur, but in so minute traces that to perceive them it is necessary to operate on a great quantity of matter. The caustic alkalis do not render it green, either cold or hot. If it be thrown on a filter it retains a little water; and when afterwards dried on a stove it loses only two thirds of its weight. In this state, instead of having a horny appearance, like glairine, it presents a uniform, friable, solid mass, and does not swell in water. The water which runs through the filter is as inodorous as the substance itself, and it contains a very small quantity of *zoïodine*. When decomposed in a glass tube it exhales the odour of burnt horn, and yields gases which strongly restore the blue colour of reddened litmus. Lastly, glairidine yielded by analysis very evident traces of iodine, which, as already stated, glairine did not.

ZOÏODINE.

The author has given this name to a new substance from two Greek words, expressive of its azotized nature and its violet colour. In order to obtain it, it is requisite to employ very white glairine, which cannot be procured except when the sulphurous waters are in a state of perfect purity, and nearly at their maximum of sulphuration. This substance exists in the state of strongly iridescent scales of a fine deep violet colour; it has neither taste nor smell; it is unalterable by the action of light and air, and is insoluble in water. By concentrated nitric acid it becomes of a yellowish-red colour, and of a rather deeper yellowish-red by hydrochloric acid; concentrated sulphuric acid renders it of a fine blood-red colour. Oxalic and phosphoric acids also redden it, but not so strongly as the preceding acids; acetic and arsenic acids produce no sensible effect; and in all cases diluted acids act almost as powerfully as when concentrated. Chlorine does not alter it; alkalis render it of a brown colour, which the stronger acids bring back to red. Lastly, when heated in a glass tube, it decomposes without subliming, and leaves a coaly residue, upon which the acids exert no action..—*Journ. de Ph. et de Ch.*

ON CIRCULAR MAGNETIC POLARIZATION.

By M. A. BERTIN.

Since the discovery of Prof. Faraday, circular magnetic polarization has formed the subject of several important investigations; but nevertheless

there still remain some conditions of the phenomenon to discuss, some conclusions to verify, some obscure points to clear up. I have attempted to do this, aided by the valuable assistance of MM. Pouillet and Edmund Becquerel, who have kindly placed at my disposal the apparatus they made use of in their researches on this subject.

The method of experimenting is now too well known to require description. I shall only say that all the numbers referred to in this paper represent the total rotation produced in the plane of polarization by a change in the direction of the current. It is this total rotation which I have always measured, as it is immediately presented in the experiment; because, corresponding to a more intense phenomenon, it is for that very reason measured with greater accuracy; and lastly, because it is independent of the determination, always very uncertain, of the zero, that is to say, of the position of the analyzer, for which the light was extinguished before the passage of the current.

As is seen, the measurement of the rotation results from the determination of two planes of polarization, or of two tints of passage; each of these observations being liable to an error of $\frac{1}{4}$ degree, it is necessary to admit the possibility of an error of $\frac{1}{2}$ degree in the rotation, which moreover also is subject to the influence of small irregularities in the transmission of the current by the commutator. The variations which affect the current itself during a series of experiments would produce differences far more considerable, which must be avoided by comparing only the rotations observed at short intervals, and, as it were, the one following the other.

It has been observed, that for the success of these experiments it is indispensable that the glasses experimented with should be annealed; but happily this is not the case, otherwise these researches would be impossible, since the greater part of them are unannealed, or soon become so. When such a glass is suitably placed between two crossed Nichol's prisms, one or several black lines appear in it, which serve as index-points. On viewing one of these lines, which may nearly always be isolated in the field of vision, it is seen to disappear when the current passes; and it is again found, on turning the analyzer, absolutely like the black image of annealed glass. In white light it experiences the same variations of tints as this, and it is always easy to determine the azimuth in which it presents the tint of passage. It is true that, in consequence of the movement of the plane of polarization, it is not the same black ray which reappears, but another slightly different. However, the rotation is not influenced by this circumstance, for I have ascertained that it is independent of the black ray to which the eye is directed.

The most happy modification which has been made in the original apparatus of Prof. Faraday has been to cause the ray of light to pass, not merely near the line of the poles, but through this line itself, by piercing the electro-magnet in this direction. This condition is satisfied in M. E. Becquerel's electro-magnet by the perforated terminations which he places on the two poles, and to them must be attributed the greater part of the force of this apparatus. The following table leaves no doubt on this point:—

ROTATIONS OBSERVED WITH THE ELECTRO-MAGNET OF M. BECQUEREL.

Substances placed between the Two Poles.		With the Terminations.	Without the Terminations.
	mm.	°	° ′
Very thick flint-glass	55.1 thickness.	21 00	4 30
Faraday's flint-glass*	48.3 "	25 6	6 30
.. ..	18.3 "	18 20	2 30
Distilled water.	130.0 "	5 30	3 00
.. ...	30.0 "	3 50	0 00

* I am indebted to M. Dumas for this flint-glass.

The same condition is still better satisfied in Ruhmkorff's apparatus, where the helices themselves are pierced in the direction of their axes. The Ecole Normale has such an apparatus, 54 kilogrammes in weight, which is as powerful as that belonging to M. Becquerel, although it is not more than one third its weight.

The effect produced by an electro-magnet of the same shape depends on the mass. Thus, an apparatus one fifth the size of the preceding produced, under the same circumstances, rotations twice as feeble.

The dimensions of the wire have also a certain influence. In general it should be thick. That used in the Ruhmkorff apparatus is 2.50 millims. in diameter; and in M. Becquerel's electro-magnet the maximum effect is obtained by doubling the section of the conducting wire. With respect to the mass employed, the instrument-makers at present are in the habit of rolling around the iron nucleus a thickness of wire equal to its radius, so that the external diameter of the reel is twice that of the interior cylinder.

Lastly, the intensity of the phenomenon likewise depends on the current, or rather on the relation existing between the dimensions of the electro-magnet and the force of the battery exciting it; so that a very powerful apparatus may appear very feeble when it is not set in action by a battery of sufficient strength. With the same apparatus the intensity of the effects produced increases with the intensity of the current; as to this, it increases with the number of the elements of the battery, but is far from being proportional to it. Again, when the current has a certain force, it is more advantageous to increase the quantity of electricity than the tension; that is to say, it is better to enlarge the surface than the number of the elements of the battery. It is therefore desirable to ascertain what is the arrangement for a given battery which will produce the maximum effect. Thus, having at my disposal 80 Bunsen's elements, I have found that the best arrangement to be given to them in order to excite the great Ruhmkorff apparatus was to join, by poles of the same name, four batteries of 20 elements. The results just stated follow from the subjoined table, which contains the rotations observed in one of Faraday's flint-glasses of 39 millimetres in length placed between the two poles of the Ruhmkorff apparatus:—

Number of Elements.	Tension of the Battery.	Surface of the Battery.	Rotation Observed.
			° ′
80	80	1	23 30
80	40	...	25 20
80	20	4	26 30
40	40	1	20 30
40	20	2	22 30
40	10	4	18 30
20	20	1	17 30
20	10	2	16 40
20	5	4	13 00
10	10	1	14 30
5	5	1	10 00
1 selected element	1	1	9 30

By means of the above-mentioned apparatus I have been able to make the experiment so as to render it visible at a public lecture. The arrangement presents no other difficulties than those resulting from the narrowness of the beam of light traversing the electro-magnet. I therefore removed the diaphragms placed at the extremities of the helices, and was then able to work with a ray of light of two centimetres in diameter. This ray proceeded from a lamp of M. Soliel's construction, placed before one of the reels. It traversed successively a polarizer formed of one large pile of glasses, a Faraday's flint-glass, of 48 millimetres, placed between the two reels and in contact with them, an analyzer formed of a large doubly refracting prism, and then a convergent lens which projected it upon a screen. One of the two images of the prism having been extinguished while the current passed in a certain direction, it was seen to reappear as soon as the direction of the current was changed; and it was again extinguished, or rather it was brought to the tint of passage by a suitable rotation of the analyzing prism. But the experiment is much more striking when a doubly rotating Soleil's plate of quartz is placed behind the polarizer. The lens then projects upon the screen two images of complementary tints, the two halves of which, brought at first to an equality of tints by means of the analyzer, change in a contrary direction as soon as the current is altered. On turning the analyzer a certain extent we reobtain an uniformity of tint in each image. This experiment is precisely the same as that of M. Pouillet.

The direction of the rotation impressed on the plane of polarization was correctly recognised by Prof. Faraday, and may be determined in a simple manner. The rotation has the same direction as the current which produces magnetization, or rather it has the same direction as the current which, according to Ampère, would be established under the influence of an electro-magnet in a piece of soft iron inserted in the place of the substance experimented with.

It may not be without interest to connect this general law with the theory which M. Fresnel has given of circular polarization. After having shown that a ray of light polarized at right angles can be decomposed into two others polarized circularly in a contrary direction, and *vice versâ*, it sufficed for him to suppose that a plate of quartz cut perpendicular to the axis has the property of allowing to pass, with unequal velocities, rays polarized circularly in one or other direction, and all the rotatory properties of the quartz followed from this simple supposition. Let us admit, in like manner, that the presence of the electro-magnet, or of a circular current, which is the same thing, communicates to transparent bodies the property of allowing the circularly polarized rays to pass more easily, the luminous molecules of which rotate in the same direction as the current, and the general law which I have announced will result from this simple hypothesis.

To be convinced of the accuracy of this law, it suffices to observe, as I have done, the direction of the rotation for all positions of the glass, or of the transparent substance in general, in relation to the current.

First.—If the glass is placed between the two poles of the electro-magnet, two cases may occur.

Either these two poles are directly opposed to the glass, as is the case in Ruhmkorff's apparatus: then there is no doubt as to the direction of the current. For instance, on viewing the glass from the surface which touches the south pole, we see that it is subject to a current proceeding from left to right; and the rotation observed is, in effect, in this direction;—it changes direction with the current. Or the two branches of the electro-magnet, instead of being in the axis of the glass, are perpendicular to it, which takes place in the iron horseshoe electro-magnet, and then the currents are oblique in relation to the glass, or parallel to its axis. But the effect ought always to be the same as above; for a piece of soft iron inserted in the place of the glass would assume the same poles in both cases: only the intensity would be much less; and, to increase it, it would be necessary to bring the polar axes nearer to that of the glass. This effect is produced by M. Becquerel's terminations.

Secondly.—In a straight electro-magnetic helix traversed in the direction of its axis by a ray of light, the current is in the same direction the whole length; consequently the rotation observed ought to be in the same direction, whether the glass is placed in front or behind; and if the helix is viewed from the south pole a rotation to the left should occur: it would be to the right if the helix were viewed from the other pole, or, which comes to the same thing, the current is changed without altering the position of the eye.

Hence it follows that in an apparatus formed of two similar helices the direction of the rotation should be the same when the flint-glass is between the two helices or reels as when it is at

the extremities so ; that in the whole length of a file of reels thus arranged the direction of the rotation should not change.

If, then, several glasses are placed in the intervals separating these reels, the rotations produced by all these glasses will add to each other, and thus give the means of multiplying indefinitely the action of a substance, and consequently of rendering that action visible, however feeble it may be.

All these suppositions are confirmed by experiment, as I have found by means of two systems of straight reels. In the one system, consisting of two reels, 28 centimetres in length, and enclosing an iron nucleus, 8 centimetres in diameter, both of them in contact with the flint-glass of Faraday, of 48 millimetres in length, produced a rotation of nine degree. The other system, consisting of four reels 10 centimetres in length, and enclosing a cylinder of 3 centimetres in diameter, perforated likewise in the direction of the axis; they are centred one after the other in a wooden trough. This file of reels, including the external ones, presents five intervals in which the substances submitted to magnetism may be placed. Some experiments made with this apparatus are here added.

I.—EXPERIMENT MADE WITH FIVE CELLS CONTAINING SULPHURET OF CARBON ONE CENTIMETRE IN THICKNESS.

	Rotations. ° ′
With five cells placed in the five intervals	8 5
With the two outer cells removed	6 65
With only the centre cell left	2 00
The five cells in contact, with two reels on either side	4 00

II.—EXPERIMENT ON WATER.

With one cell placed between the first and second reels	0 55
With a second placed between the second and third reels	1 40
With a third placed between the third and fourth reels	2 30
With two reels placed on either side of the three cells	1 20

III.—EXPERIMENT ON FLINT-GLASS.

With a very thick flint-glass, of 55 millimetres, placed between two reels	5 00
With Faraday's flint-glass, of 48 millimetres	6 10
With two flint-glasses placed at two different intervals	11 10
The two flint-glasses in contact, with two reels on either side	9 30

The last experiment of each series clearly shows that the increase observed in the rotation depends, not on the increase in thickness of the magnetized substance, but on the distribution of its different layers in the intervals between the reels. I need not observe that, in employing successively all these intervals during the experiment, the reels remained strictly in the same position, and consequently retained their magnetism intact.

Thirdly.—In a helix perpendicular to a polarized ray, as, for instance, in a vertical reel receiving on its upper base the glass traversed by the light. If this is rotated around the pole, placing it successively on all the radii of the reel, a rotation in the same direction is found on viewing it always from the same surface; for instance, from that which is turned towards the pole ; and this rotation is to the right if the pole is southern, to the left if it is northern. The rotation again changes direction when the glass is viewed from the opposite surface.

It follows, therefore, that if the glass is viewed placed in two symmetrical positions in relation to the pole, the position of the analyzing prism being fixed, we shall observe rotations of contrary directions. Consequently, if, employing the horseshoe electro-magnet, we look through the flint-glass always placed on the line of the poles, but successively at the extremities and then in the middle, we should observe, as M. Pouillet did, rotations of the same direction outside the poles, but in the middle a rotation in the contrary direction.

These positions, where we observe change of direction in the rotation, are separated by others where there is no effect; the latter are precisely at the poles. But it was seen that in this case a rotation was perceived on looking in the axis of the current, or of the magnet supposed to be perforated in this direction.

Wishing to assure myself that in the electro-magnet of M. Becquerel, the axis of which is filled up, the rotation on the pole occurred in the same manner as in the hollow reels where I had observed it, I endeavoured to receive the ray in the axis of the reel by the aid of reflection. For this purpose I fixed Nörremberg's apparatus on the pole. The tinned horizontal mirror being placed directly on the end face of the electro-magnet, I received on the oblique glass the light of the clouds. This light is, as is known, reflected a first time from above downwards upon this glass ; then a second time on the horizontal glass, which sends it vertically from below upwards to the analyzer ; only, from its being very imperfectly polarized, it is difficult to determine the plane of polarization, and consequently the rotation which it might experience. But this becomes easy by placing upon the crystal-bearer the double rotating plate of M. Solcil. The position of the plane of polarization is then determined by that of the analyzing prism, which gives the equality of tints in the two halves of the plate. With this arrangement let us place upon the horizontal mirror the flint-glass of Professor Faraday. As long as the current does not pass we observe no change, except that which arises from a slight unannealed condition of the glass ; but as soon as the current passes we see the double rotation-plate vary its tints in an extremely brilliant manner ; and to re-establish the identity it will be necessary to turn the analyzer 10 degrees if the flint-glass is 18 millimetres in thickness, and 21 degrees if it is 48. As to the direction of the rotation, it takes place from right to left when the pole is southern, and from left to right when it is the contrary.

This method allows of our observing the action of an electro-magnetic reel parallel to its axis, in another direction than this axis ; and the results thus obtained deserve attention.

Let us picture to ourselves the horizontal section of the electro-magnet of M. Becquerel. It is composed of two equal circles corresponding to the two vertical arms, not exactly touching, but only 1 centimetre apart and 23 centimetres in diameter. Each of these circles is formed by an interior circle of 11 centimetres, which is the section of the iron nucleus, surrounded by a copper ring of 6 centimetres in width, appertaining to the reel properly so called. If the flint-glass is moved along the line of the centres whilst the electro-magnet is in action the following takes place :—In the middle, equidistant from the centres, the rotation will be null ; it will increase until in contact with the iron, where it will be 9 degrees; then quite close to it, on the iron nucleus, it will increase suddenly to 21 degrees. It will remain nearly fixed throughout the whole extent of this circle except in the centre, where it will be somewhat less; then on the outside of this circle it decreases, but less rapidly than it increased at first, being 13 degrees at the interior portion of the copper ring, 7 degrees at the circumference, and 3 degrees at 1 centimetre distance, which corresponds with the initial position of the centre; finally, it will still be perceptible at more than 1 decimetre.

During this progress the rotation will not have changed direction ; it will always take place from right to left if the pole is southern, and from left to right if it is northern. These phenomena are interesting when compared with the directly opposite phenomena, which are observed in the direction of the line of the poles ; so that with the same position of the flint-glass the rotation may be right or left, null or very powerful, according as it is viewed parallel or perpendicular to the current. Is it necessary to add, that in all cases the direction of the rotation is always determined by the general law which I have stated at the commencement ?

As I have just observed, that which strikes us at first, when Nörremberg's apparatus is employed, is the great intensity of the action observed over the pole. It depends on two causes ; one portion must be attributed to the circumstance that the current acts in the very direction of the luminous ray, instead of being oblique to it ; but this especially depends on the reflection of the ray, which is thus compelled to traverse the magnetized substance twice. This double passage through the quartz would have the effect of causing its natural rotatory power to disappear, by producing two equal rotations of contrary direction, because the rotation of the quartz is independent of the direction in which it is viewed. This is also an excellent method of proving the circular magnetic polarization in quartz, as it is requisite first of all to destroy the atomic polarization in this substance, as remarked by M. Becquerel. In magnetized flint-glass, on the contrary, during the double passage of the light through its thickness, the current acts so as to produce two rotations of the same direction, and consequently the effect is found to be double. I convinced myself of this by making two experiments ; the first according to the usual method, by looking directly through the flint-glass, and the second by causing the ray of light to traverse it twice by means of Nörremberg's apparatus. The rotation was always twice as great in the second case as in the first. This influence of the reflection on the intensity of the magneto-rotatory power had already been discovered in a different manner by Prof. Faraday.

The change of rotation with the direction in which it is observed establishes between the magnetized flint-glass and quartz a difference which is rendered still more perceptible by the experiments just cited. However, that is nearly the only difference. The dispersion of the planes of polarization for the different colours is the same in the two bodies. I have proved it in the following manner.

With the flint-glass placed between the two poles of the electro-magnet under the most favourable conditions to produce a great rotation (29 degrees), I counterbalanced this rotation by the contrary effect of a plate of quartz of the requisite thickness, which is easily obtained with M. Soleil's compensator. The system was then perfectly neutral, and would remain so in every position of the analyzer, if the quartz and magnetized flint-glass acted in the same manner on the light, which is, in effect, what I have observed in all the different kinds of flint-glass I have experimented with.

[*To be continued.*]

NOTE ON THE GEOLOGICAL STRUCTURE OF THE ASTURIAS, PARTICULARLY IN REFERENCE TO THE NUMMULITIC EOCENE, AND THE CARBONIFEROUS PALÆOZOIC ROCKS OF THAT PROVINCE.

*Extracted from a letter of M. E. de Verneuil addressed to Sir Roderick I. Murchison.**

In a tour which he is now making in Spain, M. Ed. de Verneuil has observed, that on the frontiers of the provinces of Asturias and Santander the nummulitic formation overlies all the true cretaceous rocks, and that no form of the genus nummulina, D'Orb., ever occurs in them ; thus fortifying the generalization recently announced by Sir Roderick Murchison, deduced from a study of the Alps, Apennines, and Carpathians, viz., that the nummulitic group of Southern Europe, and which extends over such an enormous area in Asia, is the true eocene

* Communicated by Sir R. I. Murchison to "The Philosophical Magazine."

tertiary of geologists. The cretaceous or uppermost secondary rocks of the north of Spain consist of two great stages, the lower of which is the Diceras limestone, and the uppermost a group of limestones and argillaceous sandstones, &c., with hippurites, radiolites, and orbitolites. The last-mentioned bodies have been supposed to be nummulites; and hence has arisen the mistake of supposing that nummulites and hippurites are associated in those limestones of the south which represent the chalk of the north of Europe. Above the zone of orbitolites is a yellowish limestone with spatangi, which, representing the upper chalk of the north, is widely developed at Santander, between the town and the lighthouse.

The nummulite limestone then follows as the next deposit in ascending order, and is overlaid, as in the Alps, by sandstone, &c. In this formation M. de Verneuil discovered, in addition to nummulites, the Serpula spirulæa, Conoclypus conoideus, Ostrea crassissima or gigantea, fossils so well known in the nummulite rocks of the Alps, Vicentine, and Crimæa. This eocene group, whose fossils are so distinct from those of the cretaceous system, nevertheless follows all the flexures and dislocations of the latter, just in the manner recently described by Sir Roderick Murchison in the Alps and Apennines. The same relations, zoological and stratigraphical, are said (on the authority of Don Amalio Maestre, the inspector of mines of the Asturias) to extend from Aragon towards Valencia.

In describing the principal features of the carboniferous rocks of the Asturias (some of the peaks of whose limestones rise to upwards of 8,000 feet above the sea), M. de Verneuil shows that the chief seams of coal are fairly intercalated with courses of limestone and schists charged with the well-known British species *Productus antiquatus*, *P. punctatus*, and various marine fossils. In this and in other overlying stages with conglomerates, &c, containing coal, there is, the author observes, no sandstone or schist which can have served as a soil on which jungle or marsh plants can have grown; and, seeing the alternation of the fossil vegetables with marine deposits, he concludes that these coal-fields, like many others, and particularly those of the Donetz in Russia, described by Sir R. Murchison and himself, were formed in estuaries of the sea by the transport and subaqueous deposit of terrestrial spoils, and are not referable to the same origin as certain carboniferous strata of the British Isles, America, &c., the coal-beds of which are supposed to have been formed of vegetable masses *in situ*. In the second stage of this carboniferous formation, M. de Verneuil discovered that courses of calcareous schists were loaded with fusulinæ—a point of very great interest; since these foraminifera have been described in the mountain limestone of Southern Russia, and were subsequently discovered by M. de Verneuil in the carboniferous limestone of the United States of America. Their occurrence at this intermediate station in Spain is, therefore, highly interesting in extending our acquaintance with the uniformity of distribution of animal life in the palæozoic ages. The coal-fields of the Asturias (of which there are seventy workable seams) seem therefore to be subordinate to the mountain limestone, like those of the north of Northumberland, the south of Scotland, &c. &c.

The Devonian system has been found to abound in the north of Spain, chiefly through the researches of M. Paillette, who has transmitted many of its fossils to France, where they have been described by M. de Verneuil.

The Triassic and Jurassic systems are also stated to be considerably developed in Spain, and, like the palæozoic rocks, they are highly dislocated.

In conclusion, the author remarks that the interesting region of the Asturias will soon be better known, first through a very exact geographical map prepared by M. Paillette, particularly in reference to its coal-fields; and next by a general geological map of the province by Don G. Schultz, on which that gentleman has been occupied during four years, and which is spoken of as a work of great merit.

ON THE PREPARATION OF A PURIFIED SOLUTION OF SHELLAC.

By Dr. L. ELSNER.

For many years past cabinetmakers have employed an alcoholic solution of bleached shellac for coating white woods with a polish. The bleaching of the shellac is generally effected on a large scale by chlorine or some of its compounds, and the bleached shellac then costs from two shillings and sixpence to three shillings per pound, while excellent orange shellac may be had at tenpence to one shilling per pound. If the shellac which has been bleached by chlorine or some of its compounds, or by sulphurous acid, retains even a small quantity of the body employed for that purpose, it frequently happens that, in polishing furniture in which there are any inlaid metallic ornaments, the latter become more or less tarnished. A method, therefore, for purifying the solution of the yellow shellac, without the employment of chlorine, sulphurous acid, or any similar substance, would have a twofold advantage; in the first place, there would not be the least fear of injuring the metal; and in the second place, it would be far less expensive than the solution of the bleached shellac in spirit of wine.

To obtain the object in view, Dr. Elsner turned his attention to the application of charcoal, both animal and vegetable. From a series of experiments it became evident that the animal charcoal (granulated bone charcoal) alone was capable of yielding a practical and satisfactory result. For this purpose, equal quantities of light-coloured shellac were dissolved in alcohol of 0.833 sp. gr., by digestion at a gentle heat, and the two different kinds of charcoal added respectively to the solutions. The digestion was now carried on for several days, and the solutions were then filtered through coarse blotting-paper.

The solution which had been digested with animal charcoal had a light brownish colour, was transparent and clear; maple, beach, and poplar were readily and beautifully polished by means of this solution; while that which had been digested with vegetable charcoal was found to be of a darker colour after filtration than it had been before. The solution of the purified shellac may be readily prepared, on a large scale, in the following simple manner:—Any given quantity of yellow shellac, previously broken into small pieces, is conveyed into a glass flask; alcohol of 0.833 sp. gr. is poured upon it, and the whole heated on the hob, or, in the summer, in the sun, until the shellac is dissolved. Coarsely powdered animal charcoal is now added to the solution in quantity sufficient to form with it a thin paste. The flask is closed, not quite air-tight, and left for some time exposed to the sun; in eight to fourteen days a small sample is filtered, sufficient to ascertain whether it has acquired a light yellowish-brown colour, and whether it yields a clear, pure polish on light wood. If this is found to be the case, it is filtered through coarse blotting-paper, for which purpose it is best to employ a tin funnel, with double sides, similar to the funnels employed in filtering alcoholic solutions of soaps, in the preparation of the transparent soaps, opodeldoc, &c. The space between the two funnels is filled with hot water, and the upper aperture covered with a tin lid. By this arrangement the spirituous solution is kept warm, and does not stop up the pores of the paper. The tin cover prevents the evaporation of the spirit. The portion which first passes may be preserved separately, and be employed as a ground or first polish. Some more spirit is poured over the charcoal on the filter, and the solution obtained used as a last coating. The solution of shellac purified by animal charcoal has, it is true, a brownish-yellow colour, but it is perfectly clear and transparent. When diluted with alcohol the colour is so slight that it may be used in this state for polishing perfectly white wood, such as maple, poplar, and lime, without the wood acquiring the least tint of yellow. Several cabinetmakers of Berlin have employed the shellac polish thus prepared, and are perfectly satisfied with the results. Dr. Elsner has also received a communication from Brunswick stating that it has given satisfaction.

THE CHEMICAL TIMES.

SATURDAY, JULY 28, 1849.

THE CHOLERA, AND THE NOSTRUMS RECOMMENDED AGAINST IT IN THE COLUMNS OF THE DAILY PRESS.

We have repeatedly had occasion to animadvert upon the unfortunate tendency of some of our political contemporaries to meddle with scientific questions, and to comment and decide upon them in their divers aspects and bearings with truly magisterial aplomb, although they usually happen to know very little, indeed, of the matters which they thus learnedly discuss, to the great admiration of their readers—admiration at their vast and seemingly universal acquirements on the part of those who *do not*, at their *coolness* and self-possession under trying circumstances on the part of those who really *do*, understand the matter. Of late, however, the system of *doing the scientific* in the leading columns has obtained much less than used to be the case; but we find to our dismay that another and a hardly less pernicious nuisance has crept in to a most alarming extent. We allude to the daily insertion in the columns of the *Times* and other leading journals of a perfect avalanche of letters on the cholera, its causes, origin, and the best way of treating it.

If these letters were written simply by physicians and surgeons, there might be no very great harm in their publication, although we hold decidedly that this species of giving general advice through the columns of a newspaper is, to say the least of it, objectionable in principle, and adapted rather to mislead than to guide those whom it professes to counsel. But when we find in the columns of the *Times* and other journals letters from "Amicus," "Paterfamilias," "Materfamilias," "Constant Readers," "One who has been in Spain," "One who has been in India," "Mirabile Sanatus," and a host of other good people, vaunting each respectively a nostrum of his or her own, we think it is time that an energetic protest should be made against a system which can only tend to aggravate the ravages of the cholera, by throwing the treatment of that fearful scourge back into the sterile domain of the wildest empiricism, from which it may be said to be only just now on the point of emerging. When we consider the thousand and one *infallible* preventives and curatives that we see daily put forth by somebody or other, we marvel at the comparative smallness of the numbers which are "reported to have died of cholera," and at the large proportion of those who would seem to have recovered from it. The writer of one letter ("Amicus") tells you that common salt is an infallible remedy in all cases

of cholera; in another letter olive oil is recommended; in a third you are told to take rice-water and go to bed, and to stay there until you get either better or worse, in which latter case you are kindly advised to send for the physician, who, let *us* add for your consolation, will probably arrive just in time to see you "off." One of these "foes to cholera" endeavours to impress upon your mind the paramount virtue and efficacy of heat; another patronizes ice, or ice and salt, to make it more refreshing; a third tries to combine the two extremes by an agreeable mixture of cold within and hot without, *i.e.*, ice and salt internally, and hot frictions on the epigastric region. Even qualified medical practitioners join with Amicus and Co. in noble emulation—and differ just as much. The one would keep you rather high; another enforces the necessity of low diet; a third prohibits altogether the use of food. One will advise you to take opium alone; another opium and sulphuric ether; a third will pour down your throat all the essential oils imaginable; a fourth will triumphantly point to camphor as *the* remedy; a fifth will gravely counsel you to take sulphate of zinc, which, as a strong emetic, must, of course, prove a formidable foe to the cholera! And every one of these gentry stamps his nostrum with a most strongly-asseverated "Probatum est."

Now, we would candidly ask our contemporaries whether they consider it well or wise that an extensive circulation should be given to suggestions and recommendations such as we have pointed out here, and of which by far the largest number proceed from individuals utterly ignorant of the subject on which they presume to give advice? How many unfortunate sufferers may not be thus entrapped into the use of some or other of the nostrums patronized apparently by the "leading journal of Europe"? How many of them may not become the victims of such irregular medication?

We strongly recommend these points to the serious consideration of our contemporaries.

HEALTH OF LONDON DURING THE WEEK.

[From the Registrar-General's Return.]

The return for the last week records the further progress of the prevailing disease. The deaths from all causes, which in the two previous weeks were 1,070 and 1,369, rose in the last to 1,741; a number which exceeds the average of the season by 733. In the two previous weeks the deaths caused by cholera were 152 and 339; but in the last they have reached 678, whilst the weekly average is only 8. Of the 678 persons who have sunk under the epidemic, 355 were males and 323 females, a more equal distribution than in previous weeks; the rate of increase is apparent in the fact that in each of the last two weeks the mortality from cholera has been about double that of the week immediately preceding. The mortality from diarrhœa and dysentery also increases, the deaths in the three weeks having been 54, 100, and 146; while the weekly average of the season is not more than 84. The whole mortality from the three diseases, in the last week, is therefore 824, and gives an excess on the average of 732, which almost exactly coincides with the excess of mortality from all causes as stated above. The diarrhœa was fatal in a large proportion of cases to children under two years of age. The increase of cholera is observed in each of the five metropolitan divisons except the northern, which comprises Marylebone, Pancras, Islington, Hackney, and Hampstead; where the deaths in the week were only seven. But it is chiefly remarkable on the south side of the river, where the deaths in the last three weeks were successively 93, 192, and 443. In Newington they were 53; in St. George, Southwark, 51; in Bermondsey, 64; in Lambeth, 106. In Rotherhithe the deaths were 37, the same as in the previous week. Typhus continues near the average; whooping-cough above, scarlatina and smallpox considerably under, it. Two persons died of privation; three of intemperance.

The mean reading of the barometer in the week was 29.692, and lower than in the previous week. The mean temperature was lower than the average, except on Monday and Tuesday. The highest occurred on the former day, and was 83.6. The mean of the week was 60.5, less by 6° than in the previous week.

[From the Board of Health.]

RETURN OF CHOLERA CASES FROM THE 13TH TO THE 23D DAYS OF JULY, BOTH INCLUSIVE.

	Attacks.	Deaths.
In London and vicinity....	1,601	721
In England and Wales....	2,557	1,036
In Scotland	81	41
	4,239	1,798

RETURN OF CHOLERA CASES, JULY 24.

	Attacks.	Deaths.
In London and vicinity ..	238	126
In the country	1,009	468
In Scotland	28	7
	1,275	601

THE CHOLERA.

BLACKFRIARS-ROAD.

On Monday evening, the 23d inst., a meeting of the inhabitants of the Blackfriars district was held at the Old King's Head Tavern, Blackfriars-road, for the purpose of taking into their consideration the rapid and alarming increase of the prevailing epidemic in their vicinity, and causing instant attention on the part of the authorities to the choked and defective state of the sewers, Dr. Evans in the chair. The bills convening the meeting stated also that great annoyance was created by the yards of some knackers, boneboilers, and catgut-makers, who carried on their business in the vicinity, and the offal from whose premises ran into a sewer, without any outlet, and which was in consequence in a very dangerous state. Several gentlemen addressed the meeting at length, pointing out the danger arising from the evils they complained of, and the following resolution was, with some little opposition, agreed to:—

"That the rapid increase of cholera in the neighbourhood of the Blackfriars-road may be in a great measure attributed to the extremely defective state of the sewers, and in many cases the want of them amongst the dwellings of the poorer classes, but more particularly to the pestiferous stenches arising from large masses of decomposing animal matter, in every stage of putrefaction, accumulated in boneboilers' and knackers' yards, and which are perfectly beyond endurance, and seriously injurious to the public health. This meeting resolves that measures be adopted forthwith for bringing the matter under the consideration of the proper authorities."

A second resolution, adopting a petition to be presented to the metropolitan commissioners of sewers, was also agreed to, and the meeting separated, after thanking the chairman.

LAMBETH.

During the past week several gentlemen connected with the parish and borough of Lambeth have been making a sanitary inspection of the borough, with a view to ascertain whether the extraordinary number of deaths that is daily taking place from cholera is attributable to the want of proper sanitary arrangements. The result of the inquiry, so far as it has at present been made, shows that, unless some speedy means be adopted for removing the pestilential smells occasioned by the various obnoxious works carried on, the spread of the disease will be most fearful. The part of the borough to which the gentlemen have particularly directed their attention is that which runs from Lambeth Palace towards Vauxhall-bridge, and is bounded on the north by the Thames, and on the south by Kennington-road. This is a district covering about a square mile; for the most part it is badly drained, ill-paved, low, wet, and surrounded by all sorts of unwholesome manufactories. Leaving Lambeth Palace, a street called Upper and Lower Fore-street runs parallel with the Thames, till within a few yards of Vauxhall-bridge, where its progress is cut off by the gas-works belonging to the Vauxhall Company. In this street are boneboilers, soapmakers, tallow-melters, oilfiners, and other equally unwholesome trades. A large number of poor families live in this street, in little low houses, the rooms of which are scarcely high enough for a person to stand upright in; scarcely any of these houses have privies, the dust-heap appearing to be the common receptacle for all filth. The tide from the Thames flows up to the doors, and when it recedes it leaves all the filth from its banks opposite the houses, the stench from which when it dries is fearful. Behind it, and running in the same direction, is Princes-street; in this street, which is literally studded with courts and alleys, all densely inhabited by poor persons, there are the bonehouses of Jared Hunt and John Hunt, the soapboilers; of John Hunt, Hicks's patent grease-works, and a host of others of a like nature. When the bone-boilers are at work, which is almost every day, it is next to impossible for a stranger to pass through the street without being compelled to vomit, such an effect has the effluvium. Indeed, Dr. Baly, the physician of the Penitentiary, Millbank, which is nearly opposite, attributes the spread of cholera in that prison to the fearful stench thrown over the neighbourhood by these works, the air of which is poisoned for a considerable distance. About 800 poor families live on this immediate spot; in some houses as many as four families reside, living and sleeping in one room; one common privy serves several houses; the water is laid on by pipes only, no cisterns being provided, so that when it comes in the people are compelled to fill what vessels they have, which has to last them until it comes on again. Very few of these houses have any drains; and in one house which was visited a cellar under the front room was the receptacle for dust, rotten vegetables, and the human excrement. The slops and other rubbish in most cases appear to be thrown into the road; large heaps of decaying vegetables, pea-shells, cabbage-leaves, &c., are to be seen in nearly every one of the streets in the neighbourhood, the worst of which are Gloucester-street, Wellington-place, Salamanca-place, Brothers-row, King's Head-court, Ferry-street, Duke's Head-court, Faircloth-court, Glass-house-street, and York-wharf-place. In some cases where the sewer runs along the road the stench from it is fearful; this is occasioned by the steam which is sent off from the factories into the drains; the consequence is that the filth therein is literally boiled, and driven up through the untrapped gulleys.

As soon as the gentlemen have completed their survey, which will be in a day or two, they intend to present a report to the parochial authorities and demand the removal of those nuisances.

ELECTRIC TELEGRAPHS.

There was an interesting collection of the most improved electric telegraphs and their appendent apparatus exhibited to a select company of ladies and gentlemen in the Music-hall, Store-street, on Saturday, the 14th inst., by Mr. Whishaw, long known to the scientific world for his ingenious inventions, chiefly in this department. His index telegraph, his uniformity of time regulator and telegraph, his telekouphonon and musical telekouphonon, besides the wire

coatings and tubings intended to protect the wire and the fluid in their transit under ground, were all inspected by the company with great interest. His chief merit appeared to himself to depend on the success with which he had constructed his instruments to transmit every description of necessary signal along one and the same wire, thereby reducing the whole expense of the apparatus to something less than a third of the sum usually charged, with additional advantages as to security from mischief, which do not belong to the system at present most in use through the country. But the two instruments that raised the curiosity of both ladies and gentlemen were the Prussian state telegraph by Siemens of Berlin, and Dujardin's printing telegraph, both contrived to work by means of a single wire. The Prussian telegraph is one selected by the Government from a variety of inventions for the lines through Prussia, and is distinguished for the facility with which a mere stranger may handle the instrument. The index-plate is horizontal and circular, with a single needle in the centre, moveable by the clock-work below when the electricity is in power; and it is surrounded by piano keys radiating to the circumference, each bearing a letter of the alphabet, or pointing at pleasure to any arbitrary sign agreed on at both ends of the line, the principle of action being that the needle immediately travels round to the key pressed down, and indicates the corresponding key at the other terminus. Dujardin's printing telegraph, as a successful invention, bears no comparison to the matchless instrument contrived by Mr. Bakewell, for the transmission of writing and any sort of tracing as far and as quick as the electricity that carries it will travel. But it was interesting as a step towards that singular result. and excited a deal of curiosity among the visitors. A piece of paper revolving round a cylinder is ticketed at intervals by a stylus wet with ink, and working under the power of the electricity issuing from the other terminus; and each letter of the alphabet is distinguished by a different number and arrangement of these marks. The instrument is wrought with great facility, but the novel kind of short-hand produced by it must be difficult, we should think, to decipher. Among the various inventions appendent to these instruments Mr. Whishaw exhibited the electric conductors in insulated coatings of gutta percha, braid, and marine glue, to fit them for being buried in the earth or suspended amid the atmospheric changes of a damp tunnel or the open air. He prefers having the conductors buried in the ground, in order to save them, not only from the constant casualties of the weather, but also the premeditated mischief of designing men, who in one hour could cut off all the electric communications throughout the country, exposed as they now are to every traveller on the highway. Mr. Henley was present also with his improved magneto-electric telegraph, constructed for two wires and with two needles on the index-plate. General Pasley inspected the whole collection, and appeared highly satisfied with the success of the different inventions.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING JULY 18TH, 1849.

George Cottam and Edward Cottam, of Winsley-street, Oxford-street, engineers, for improvements in machinery for cutting straw, clover, and hay; for grinding, for sawing wood; and in apparatus for ascertaining the power employed in working machines. Patent dated July 12th, 1849; six months.

Reuben Plant, of Holly-hall Colliery, Dudley, Worcester, coalmaster, for improvements in making bar or wrought iron. Patent dated July 18th, 1849; six months.

James Usher, of Edinburgh, gentleman, for improvements in machinery for tilling land. Patent dated July 18th, 1849; six months.

Andrew Peddie How, of the United States, now residing in Basinghall-street, engineer, for an instrument or instruments for ascertaining the saltness of water in boilers. Patent dated July 18th, 1849; six months.

Thomas Walker, of Birmingham, stove-manufacturer, for improvements in boots and shoes, and in the manufacture of parts of boots, shoes, clogs, and goloshes. Patent dated July 18th, 1849; six months.

John Holland, of Larkhall-rise, Clapham, gentleman, for a new mode of making steel. Patent dated July 18th, 1849; six months.—(Communication.)

Samuel Cunliffe Lister, of Bradford, in the county of York, Esq., and George Edmund Donisthorpe, of Leeds, in the same county, manufacturer, for improvements in preparing, combing, and spinning wool. Patent dated July 18th, 1849; six months.—(Communication.)

William Brown, of St. James's, Clerkenwell, Henry Mapple, of Childe-hill, in the parish of Hendon, electric engineer, and William Williams, the younger, of Birmingham, gentleman, for improvements in communicating intelligence by means of electricity; and improvements in electric clocks. Patent dated July 18th, 1849; six months.

NEW BREAD-MAKING MACHINE.—We recently witnessed at Exeter-hall the illustration of Mr. R. E. Lee's invention for bread-making by machinery, which does away with the necessity of manipulation almost throughout the whole process. Mr. Lee described the invention by a small working model, drawings, and diagrams, and very lucidly explained its capabilities for producing bread of all kinds, without the intervention of human labour, from the time the flour leaves the sack, until the loaf or biscuit is ready for the oven, when the simple act of picking it up and placing it on the truck upon which it is to be baked is only the act of a moment, and can be performed by a boy. Mr. Lee, in continuation, explained that the chief difference between the present method and the adaptation of the machine to the manufacture of bread consists in the use of prepared or carbonated water, in which the gas requisite for raising or sponging the dough is fixed, previously to its mixture with the flour, by which the use of barm is completely done away with, while a saving of fifteen per cent. of the nutritive properties is effected, and the bread is rendered more palatable and more wholesome. But for bakers or others prejudiced in favour of barm a detached apparatus is provided for making what is technically designated a "half sponge," in which the particles of the yeast are equally and minutely intermixed with their proper proportions of flour and water, instead of the mode now adopted of waiting until a little "leaven has leavened the whole lump." Nothing gave greater satisfaction to the gentlemen present than the complete and ingenious apparatus by which the flour and water were fed into the machine, at a uniform rate of speed, the quantity of fluid being regulated by a governor driven from the flour-feeding roller, preserving at all times the proportions between the two elements. The contrivances for adjusting the weight of each loaf, so that not the slightest variation could possibly arise, during the making of thousands of loaves, and the ready facility with which a fraction of an ounce, more or less, can be added to or taken from the weight, is very ingenious. Mr. Lee proved the machine is capable of performing every operation connected with the baking trade, either singly or simultaneously, grinding the wheat, dressing the flour, mixing the paste, kneading the dough, moulding the loaf, cutting the biscuit, filling the oven, and baking the batch by the agency of the steam which drives the engine, and which, passing through the furnace in its exhaust-pipe, receives an extra supply of heat without the necessity of great pressure. Just before the bread is drawn out the steam is shut off, and air substituted. The heat, too, is indicated and regulated by a self-acting apparatus composed of a pyrometer and throttle-valve, whereby the baker can ensure his batch against being burnt or slack-baked. A machine which would cost only £150 produces 600 loaves an hour.—*Patent Journal.*

VENTILATION OF COAL MINES.—The members of the committee of the House of Lords on accidents in coal mines met at the Polytechnic Institution on the 9th inst., to investigate the experiments made by Dr. Bachhoffner, and explained by Mr. Gurney, on the principle of high-pressure steam ventilation, and its application to coal mines. There were present the Duke of Argyll, Lords Lonsdale, Granville, Wharncliffe, and Brougham, Mr. Vivian, Mr. Foster, and many other persons connected with science and mining operations. The experiments showed the power of the high-pressure steam jets in producing ventilation to be so great that firedamp and other noxious gases, even in the largest mines, can be expelled by their adoption with great ease. The object of the committee in witnessing these experiments was with regard to the examination of Mr. Foster before the Lords, that gentleman having introduced the system of high-pressure steam at Seaton Delaval, one of the largest coal mines in the north, and his evidence on the subject being considered as highly important. Mr. Gurney was also summoned by the committee from Cornwall, and attended in consequence.

TO CORRESPONDENTS.

"Mr. Rose, Kennington," asks what we think of common salt as a preventive and curative agent in cholera? He says he saw this article strongly recommended in the *Times* by a correspondent signing himself "Amicus." We have read this letter of "Amicus." It is balderdash from beginning to end. It is deeply to be regretted that the *Times* should open its columns to every wild suggestion regarding the origin, causes, and treatment of the cholera, a disorder which remains as yet a mystery even to the most eminent physicians. The mode of treatment by olive oil taken internally has *unquestionably* given the most satisfactory results in many cases. We venture, however, to affirm equally that it has failed in as many. We suspect, after all, that the *vis medicatrix naturæ* has much more to do with the majority of cases than will willingly be allowed by the practitioners through whose hands the successful cases may happen to pass.

"R. C. W."—You will find that we have transferred the article to our columns.

"Mr. Millar, Bristol."—The expense of the patent will be about £150.

"Tyro."—Use the bicarbonate. Procure Fresenius' "Qualitative Analysis."

"Mr. Richardson, Brighton."—We can give you no advice in the matter.

"X.'s" request has been complied with."

"A. B."—The electuary of antimony is prepared as follows:—Take of prepared sulphuret of antimony, gum guaiacum, and black sulphuret of mercury, of each one drachm; confection of senna, two drachms; syrup to mix.

"T."—Under consideration.

"A Reader."—Jaumange is prepared as follows:—Take of isinglass, one ounce; boiling water, ten to twelve ounces; dissolve, and add to the solution half a pint of sweet white wine, the yolks of two eggs beaten to a froth, and the grated yellow peel of two lemons. Mix well, and boil over the fire to thicken, stirring all the time.

"R. S."—We cannot say for the present.

"Mr. Waltham, Liverpool."—Use calcined lime; you will find it the most advantageous in the end, although it is usually deemed quite immaterial whether the lime intended to be employed in the process be in a state of carbonate or otherwise.

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ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXVII.

(LECTURE C.)

VEGETO-ALKALIS—(*Continued*).

PHARMACEUTICAL PREPARATIONS OF OPIUM—(*Continued*).

SECTION II.—PRODUCTS OBTAINED BY THE ACTION OF WATER UPON OPIUM—(*Continued*).

OPIATED COLLYRIUM.

Take of Rose-water, 120 grammes.
Extract of opium, 20 centigrammes.
Dissolve.—(Hospitals of Paris.)

SYRUP OF OPIUM.

Take of Extract of opium, 1 part.
Cold water, 16 parts.
Sugar syrup, 600 parts.

Dissolve the extract in the water, filter the solution, and add the filtrate to the boiling syrup; keep the mixture a minute or so over the fire, to bring the syrup back to its original degree of concentration. Strain.

Thirty grammes of this syrup contain 5 centigrammes of extract of opium.

SUCCINATED SYRUP OF OPIUM.

Take of Extract of opium, 1 part.
Water, 20 parts.
Sugar syrup, 600 parts.
Spirit of amber, 2 parts.

Prepare the syrup of opium as in the preceding formula, and when cold add to it the spirit of amber.

Thirty grammes of this syrup contain equally 5 centigrammes of extract of opium.

TINCTURE OF EXTRACT OF OPIUM.

Take of Extract of opium, 1 part.
Alcohol at 56 C. (21° Cartier), 12 parts.

Dissolve the extract in the alcohol; filter.

OPIUM LOZENGES.

Take of Extract of opium, 1 part.
Sugar, 60 parts.
Mucilage of gum tragacanth, a sufficiency.

Mix, and make into lozenges of 30 centigrammes each.

Each lozenge contains 5 milligrammes of extract of opium.

CYNOGLOSSUS PILLS.

Take of The dry rind of the root of cynoglossus (Hound's tongue),
Hyoscyamus seeds,
Extract of opium, of each 8 parts.
Myrrh, 12 parts.
Olibanum, 10 parts.
Saffron,
Castoreum, of each 3 parts.
Syrup of opium, a sufficiency.

Pulverize the cynoglossus root and the hyoscyamus seeds together, the other substances separately. Soften the extract of opium with a little syrup, and incorporate the powders with the soft mass.

The pilular mass so prepared contains one eighth of its own weight of extract of opium.

OPIATED PLASTER.

Take of Cerate or plaster of Galienus, 120 parts.
Extract of opium, 1 part.

Mix.

SECTION III.—PRODUCTS OBTAINED BY THE ACTION OF ALCOHOL UPON OPIUM.

Alcohol at 56 Cent. dissolves a larger proportion of the constituents of opium than water. I dissolves besides the principles which are equally dissolved by the water, narcotina, the acid resin, and the oil of opium.

ALCOHOLIC EXTRACT OF OPIUM.

Cut the opium in slices, and let the latter macerate in alcohol at 56 Cent. Strain with expression, and filter. Subject the residue to several repetitions of the same process. Pour the filtered liquors together; distil the liquid, and evaporate the residue to the consistence of an extract.

From 100 parts of Smyrna opium of good quality I have obtained as much as 50 parts of alcoholic extract.

TINCTURE OF CRUDE OPIUM.

Take of Crude opium, 2 parts.
Alcohol at 56 Cent., 23 parts.

Let the opium macerate in the alcohol for eight days; strain with expression, and filter.

Twenty-four parts of this tincture correspond to 2 parts of crude opium, and 1 part of extract of opium.

PAREGORIC ELIXIR.

(*Pharmacop. Edin.*)

Take of Pure opium, 4 parts.
Benzoic acid,
Saffron, of each 6 parts.
Essential oil of anise, 1 part.
Alcohol at 88 Cent., 180 parts.
Liquor of ammonia, 70 parts.

Let the mixture macerate for eight days; filter.

The alkalis of the opium are not precipitated by the ammonia in this preparation, because they are soluble in the alcoholic menstruum.

Three grammes of this tincture correspond to 5 centigrammes of crude opium.

PAREGORIC ELIXIR.

(*Pharmacop. Dublin.*)

Take of Dry alcoholic extract of opium,
Benzoic acid,
Volatile oil of anise, of each 1 part.
Camphor, 0.7 part.
Alcohol at 56 Cent., 200 parts.

Let the mixture macerate for eight days; filter.

Ten grammes of this tincture represent 5 centigrames of the dry alcoholic extract of opium.

SECTION IV.—PRODUCTS OBTAINED BY THE ACTION OF WINE ON OPIUM.

Wine dissolves all the principles of opium which water dissolves; the alcohol and the acid principles which it contains enable it, moreover, to dissolve a larger proportion of narcotina, oil, and resin, than is extracted by water.

VINOUS EXTRACT OF OPIUM.

(LAUDANUM OPIATUM.)

Take one part of opium, cut it in slices, and let the latter macerate in four parts of white wine, operating in the same way as when preparing the aqueous extract. Strain with expression. Add to the grounds two fresh parts of white wine. After a few hours' maceration strain again. Pour the two liquors together, filter, and evaporate the filtrate to the consistence of an extract.

The vinous extract of opium differs from the aqueous extract in several points. It contains, as we have already stated, a larger proportion of narcotina, oil, and resin than the latter; it contains besides the extractive and saline principles of the wine. The proportion of morphia and codeïa contained in equal weights of the vinous and aqueous extracts is less in the former than in the latter.

Opium when treated with wine yields 1-6th more extract than when treated with water.

The vinous extract of opium is rarely employed.

OPIUM WINE.

Take of Crude opium, 1 part.
Generous wine, 10 parts.

This wine is rarely used, except in public hospitals, where cheapness is a consideration.

COMPOUND WINE OF OPIUM.

(SYDENHAM'S LAUDANUM.)

Take of Crude opium, 16 parts.
Saffron, 8 parts.
Cinnamon,
Take of Cloves, of each 1 part.
Malaga wine, 125 parts.

Cut the opium in slices; incise the saffron; pound the cinnamon and the cloves. Let the whole of the ingredients macerate for fifteen days in the wine. Strain with expression, and filter.

The opium yields to the wine narcotina, the meconate of morphia and codeïa, the resin, the acid oil, the aroma, a large proportion of colouring matter. These principles are associated in the product with the colouring matter and the volatile oils of cinnamon, saffron, and cloves.

After a certain time a rather large deposit forms in Sydenham's laudanum. M. Henry has ascertained that this deposit is constituted by the colouring matter of the saffron, which separates from the essential oil with which it was originally associated, and subsides, whilst the oil itself remains in solution. As it is solely to the essential oil that the saffron owes its medicinal properties, the separation of the colouring matter does not impair the medicinal virtues and efficacy of the preparation.

One gramme of Sydenham's laudanum represents 10 centigrammes of crude opium, or 5 centigrammes of extract of opium.

NARCOTIC LINIMENT.

Take of Compound sedative balsam, 64 grammes.
Sydenham's laudanum, 8 grammes.

Mix.

LAUDANISED CERATE.

Take of Yellow cerate, 32 grammes.
Sydenham's laudanum, 4 grammes.

Mix.

WINE OF OPIUM PREPARED BY FERMENTATION.

(ROUSSEAU'S LAUDANUM.)

Take of Crude opium, 4 parts.
White honey, 12 parts.
Lukewarm water, 60 parts.
Fresh beer yeast, a sufficiency (about 0.25 parts).

Dilute the honey in one portion of the water, the opium in the other. Mix the two liquids together, and add the yeast. Let the mixture stand in a warm spot until it has fully fermented. Strain with expression; filter, and draw from the filtrate by distillation 16 parts of alcoholate. Rectify this repeatedly in the water-bath, until the rectified product amounts only to $4\frac{1}{2}$ parts, marking 64 to 67 Cent.

Evaporate the extractive solution of the opium in the water-bath until there remain only 10 parts. Add to them the alcoholate, and filter again.

The product marks 15° at Baumé's areometer.

ABSTRACT OF A LECTURE ON CHEMISTRY.

By Prof. MILLER, of King's College.

[*Concluded from page* 80.]

Important as the science of chemistry unquestionably is, in its inseparable connection with arts and manufactures, and with the commonest actions of our lives, nay, with our very being itself, it is not for the sake of its material advantages alone that I would invite you to earnest, persevering study. If we except astronomy, no human science is so capable of developing the loftiest faculties of the mind; no science embraces within its field so vast a number of collateral sciences. Based on the rigid foundations of numerical computation, it admits the application of some of the most abstruse calculations of pure science. Its two pillars, the laws of heat and electricity, have occupied, and still occupy, the highest human intellects.

Such being the indisputable importance of the science, it behoves us to inquire how the student may best acquire a knowledge of it, which shall enable him to bring its principles into practice. In the lectures we deliver here, of course we can only illustrate those principles, and put the student in a way to work them out himself: the theory of the science may be acquired in the lecture-room, and there it may be best under-

stood and learnt, provided the lectures be followed up by a suitable course of reading.

Chemistry is a subject of such high interest that its pursuit is apt to be regarded as a recreation rather than a study; but it has difficulties as well as pleasures. Hence, while the experiments are numerous and brilliant, nothing can excel the assiduity of the pupil; but, when reason should be active, and the application of the mind be close, the student is apt to think that what is dry is unimportant, and to comfort himself with the idea that something interesting will soon occur. In this, vague notions and undefined generalities may be acquired, but never information of solid or permanent utility. I would, with the greatest earnestness, deprecate this habit at the outset of the course: it is one that inflicts the greatest injustice both on teacher and pupil. If chemistry is to be mastered, it must be by close, persevering, and diligent study: such study will be rewarded not only by the value of the knowledge you acquire, but will enable you to direct your mental powers with increased certainty of search to any other object of attainment.

Next to the correct and certain acquisition of principles, a certain facility in conducting experiments is desirable. An experiment made by your own hands in the laboratory, at leisure, excites a far more vivid impression on the mind than a similar experiment witnessed in the lecture-room. In order to carry this into effect, some training of the hands is necessary, as particular expedients are resorted to by the chemist which are best attained by practising them under the direction of one accustomed to manipulation. Further than this, instruction is requisite in the principles of analytical chemistry, and the mode of conducting chemical researches; in fact, the making of a chemist is impossible in a lecture-room. This can be done nowhere but in the laboratory. Formerly this kind of instruction was, on account of the expense, only within the reach of few: now that the demand for it has so much increased, means have been taken for facilitating its acquisition; and for a trifling expense the student may have accommodation in the laboratory, with suitable instruction, for various periods of from one to twelve months, either for acquiring the principles and processes of analytical chemistry, or for carrying on original research, and prosecuting scientific inquiry into any subject it may be desirable to investigate. Every business, every manufacture, has a chemistry of its own, which requires special study.

The agriculturist, the calico-printer, the dyer, the colourman, the soap-boiler, the sugar-refiner, the glass-manufacturer, the brewer, the distiller, the tanner, and even the maker of glue, must, ere long, each in his own defence, study scientific chemistry, or that portion of it which bears on his own business. A few illustrations relative to the nature and amount of one or two of the principal forces associated with matter will make this clearer.

We are not all equally familiar with an essential characteristic of matter namely, its association with a definite amount of different kinds of force; so that, in addition to substance, we regard it as an assemblage of points or centres of force, the amount of which force is determined by the quantity and kind of matter which may be present. A piece of iron we know to be composed of a mixture of particles separable from each other, which yet, individually, consist of the same substance. This separation of parts may be carried out to an extent far beyond what our unaided senses can perceive. Still we have reasons to know there are limits to this subdivision, and that all these ultimate indivisible particles have the same size, form, and weight. Each of these atoms is a centre, around which a certain quantity of various forces are grouped, and the amount of each force is the same for each individual atom. Thus a definite amount of heat, or of electricity, is associated with each particle of matter.

The sum of the forces by which each atom is drawn towards the earth constitutes the weight of the body, which is, therefore, strictly proportionate to the quantity of matter or the number of particles present. But, besides this force of gravity, each atom has a certain tendency to approach its fellows, and that tendency, called "cohesion," is equally definite, provided the atoms are constantly at the same distance from each other. It is this force which keeps the particles of bodies together, and prevents an iron band from possessing as little coherence as a rope of sand. Now, as different bodies, though of equal bulk, have different weights, so dissimilar substances have different degrees of cohesive strength, a force which may be expressed in numbers as exact as gravity itself. In fact, by opposing the force of cohesion to that of gravity, we arrive at a measure of the force of cohesion. Iron, it is true, varies in toughness with its quality; but perfectly pure iron, provided that its texture be entirely free from flaws, would, at the same temperature, have the same cohesive force. Now, till we are employing the whole of this force, we are not economizing our material to the utmost. The wire which you see here is capable of supporting 550lbs.; now, this wire, while it is as efficacious (as long as the weight does not exceed 550lbs.) as a rod an inch in diameter, is, in an economical point of view, far superior. Take another instance from a different force. Chemical affinity, we shall find, has its equivalent in other forces. Let us consider the production of heat by the combustion of a given quantity of charcoal. A pound of charcoal is not simply an amount of matter, drawn towards the earth with a certain force arbitrarily termed a pound weight. It is an assemblage of a definite number of small particles, each capable of exerting an amount of force of different kinds, as definite as the weight that each possesses. When this pound of charcoal is burned it gives out a certain quantity of heat, which, from careful experiment, appears to be sufficient to convert 13 pounds of water at 60° (the ordinary temperature of the air) into steam at 212°, the boiling point of water. It will boil away 13 pounds of water, and more than the heat sufficient to effect this no ingenuity has been able to extract from it. But it is plain that unless we turn thirteen pounds into steam for every pound we consume a waste of material takes place. Some waste is almost inevitable, but our exertions cannot be considered successful so long as any considerable loss is sustained; we must, therefore, reflect on the various circumstances which may produce loss. The most obvious loss arises from the escape of air from the chimney before it has surrendered to the boiler the full amount of heat which it is capable of parting with.

Another source of loss is the cooling down of the pipes and boiler after the steam has been generated, and before it has been used. In the Cornish engine, by attending to this point, four times the quantity of work may now be obtained from the same expenditure of fuel which Watt thought was doing all the work to be expected from it. But there is another important, but less suspected, mode of loss, and one intimately connected with chemical combustion; it depends on an insufficient supply of air. It is a fact that charcoal or coke may be dissipated in vapour (and may apparently be wholly consumed) by one half the amount of air that is required in an open fire, under circumstances where the full quantity of heat is given out. In this case one pound of charcoal, instead of giving out heat enough to convert thirteen pounds of water into steam, will only give out one fifth of the heat, and will, therefore, raise but two pounds and a half into steam. This important fact depends on the property charcoal has of forming two compounds with oxygen; in the first case, where most heat is emitted, twice the amount of oxygen is taken up, and carbonic acid gas, or fixed air, is produced; in the second case, a gas is obtained also, called carbonic oxide; it is colourless, and so escapes notice; but it is combustible (which carbonic acid is not), and in heating gives out a large quantity of heat. Now, the way in which this gas is produced is worth notice; it is not formed, in the first instance, by the direct union of the charcoal with the oxygen of the air, for carbonic acid is the compound which is invariably obtained; but when this carbonic acid is made to pass over red-hot coals it dissolves a portion of the coal, becomes dilated to twice its bulk, and actually, instead of increasing the heat of the furnace by the quantity of coal with which it thus unites, it most materially diminishes it, and carries it off in sheer waste.

Many of our furnaces are open to the air at bottom by the bars of the firegrate; brisk combustion take place, and the body of coke above becomes of a bright red heat; but the air is quickly deprived of the oxygen by the lowest layer of coal, the draught carries up the exhausted air, and with it the carbonic acid gas which has been formed. This gas, as it passes over the intensely ignited coal, dissolves a great portion, cools the fire, and ascends the chimney: when it has reached the top of the chimney it has become too much cooled down to take fire as it curves into the air, and so passes off unsuspected and to waste, actually carrying with it four fifths of the heat which it ought to give out, if the coal that it takes off had been burned with a due supply of air.

The economy of material is thus involved in the economy of force, and so is the saving of time and labour. Every one is capable, in a given time, with a given allowance of food, of executing a given amount of labour; and, whether that labour be beneficially employed or otherwise, the same amount of food must be consumed to maintain the functions of the body, for it is without a doubt that, indirectly and ultimately, it is the quantity of force associated with the elements of the food an individual receives which, by means beyond our comprehension, are converted into the physical force he displays in the execution of his task; the amount of force which he can exhibit being, as all experience shows, confined within certain limits. Even the brain itself, in the operation of thinking, is undergoing constant change. Physiology has sufficiently decisive grounds for the opinion that every movement, every manifestation of power, is the consequence of a transformation of the tissues of the materials which compose them; that every imagination, every affection, is followed by alterations in the chemical character of the secreted fluids; that every thought and every emotion is accompanied by a change in the substance of the brain."* The mutual relation of force, the transmutation and conversion of one force into another, forms one of the most important features of this study. Did time allow me, I would, addressing you as young men, warn you that mental as well as physical force requires economizing; and that our first part of education is to teach us how to apply that to the best advantage; but I forbear. I wish to awaken to your minds an interest in this beautiful science; and, that you may better follow me, I recommend to you the excellent "Introduction to Chemical Philosophy" of our late lamented Professor Daniell. Attend the lectures in the class-room, study the paper of Daniell, repeat and vary experiments in the laboratory, and thus, by our co-operation and concurrent study, I have no fear that we shall reap the reward of our labour.

THE CHOLERA.—M. Majendie, the distinguished physiologist and president of the Academy of Medicine in Paris, has just arrived in this country on a mission of inquiry from the French Government as to the progress and treatment of cholera in England. M. Majendie has had interviews with the General Board of Health on the subject of his inquiry.

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* Liebig, "Organic Chemistry, in its application to Physiology and Pathology."

STATEMENT IN CONTINUATION OF THE ONE PUBLISHED IN THE CHEMICAL TIMES OF JULY 28, 1849, SHOWING THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE AIR FROM JULY 22 TO 28 INCLUSIVE, AS INDICATED BY THE EVAPORATION OF WATER FROM TWO COPPER VESSELS OR SCALES, ONE INSULATED AND THE OTHER NOT. ALSO THE READING OF THE BAROMETER, THERMOMETER, DIRECTION OF WIND, AND GENERAL STATE OF THE WEATHER.

July, 1849.	Barometer.		Therm.		Scales.				Wind.		General State of Weather.
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Insulated.	Non-Insulated	Morning.	Evening.	
22	30.05	29.95	62	61	5 I.	..	5	..	NW.	SW.	Fine all day, but rather cloudy.
23	29.75	29.65	63	61	15 I.	..	15	..	SW.	SW.	Alternately heavy showers and sunshine till five o'clock; fine evening.
24	29.50	29.45	62	58	..	5 I.	5	..	S.	S.	Overcast, dirty white, with black clouds underneath, from which fell torrents of rain all day.
25	29.45	29.50	59	60	10 I.	10 N.	10	10	SW.	W.	Fine till noon; heavy thunder showers from one till five o'clock.
26	29.55	29.65	64	57	10 I.	15 N.	10	15	SW.	W.	Fine morning; violent thunderstorm, with a deluge of rain, from twelve to five o'clock, and rain till seven o'clock. Several persons killed by the electric fluid.
27	29.85	30.00	59	58	..	10 N.	..	10	W.	W.	Generally fine all day; showers at noon, and at eight o'clock evening.
28	30.05	29.95	63	62	10 I.	..	10	..	W.	SW.	Fine all day, but rather cloudy.

During April, May, and June the electric state of the air was very low, or that of the earth high; the differences of evaporation from the insulated and non-insulated vessels being represented by the numbers 20 to 515—60 to 695—and 65 to 660.—(See Table in No. of 7th July.) During the first eight days of this month it was in an immediately opposite condition, the numbers being 260 to nil, indicating a violent reaction. The cholera made its appearance about the end of May, and attained its height about the middle of this month, it being now on the decline;—a fact affording evidence that the electric condition induces a progression to a state, or chemical action in the body, which develops itself at a particular stage on the increase of some exciting cause, that most calculated to provoke it being obviously deleterious compounds in the air, which prevent the free action of the functions of respiration, such as the emanations from sewers, or from decomposing animal and vegetable matter, which have also a depressing influence on the system. Had, therefore, the conditions of April, May, and June prevailed throughout this month, or the violent reaction of the first eight days had not taken place, the consequences must have been most appalling, with the present state of the sewers as regards their ventilation. We may yet feel the influence of the low state of the air from the 10th to the 15th. Surely, with such evidence as this, the guardians of the public health will not much longer delay the consideration of the ventilation of the sewers; and it is to be hoped that the perfect harmony of the indications of this simple apparatus, with the changes that have taken place in the electric condition of the earth and the air within these four years, and which has shown itself so forcibly in its influence on the animal and vegetable kingdoms, may induce a reference to it by the scientific world, so that the Astronomer Royal, in the meteorological information afforded to the Registrar-General, and published weekly by that authority, may not continue in the humiliating position of having to acknowledge that his labours at the Royal Observatory consist in recording that "No electricity has been shown throughout the week at the times of examination of the instruments."—(See Comparative Statement in No. of 7th July, 1849.)

Westminster-road, July 30, 1849.

Franklin Coxworthy, Author of "Electrical Condition," &c.

ORIGINAL COMMUNICATIONS TRANSLATIONS, ETC.

ON THE ESTIMATION OF PHOSPHORIC ACID, AND ON ITS SEPARATION FROM BASES.

By H. ROSE.

[*Concluded from page* 87.]

SEPARATION OF PHOSPHORIC ACID FROM ITS COMBINATIONS BY MEANS OF SULPHURIC ACID AND ALCOHOL.

No method appeared to me more suitable, in the examination of a mixture of phosphates, for separating the phosphoric acid from the bases, than decomposing the phosphates by sulphuric acid and separating the bases combined with sulphuric acid by means of alcohol from the free phosphoric acid. All the sulphates which contain powerful bases are insoluble in strong alcohol; and only those with weak bases, such as peroxide of iron and alumina, are soluble in it, and even these but very sparingly. This method has long been employed with considerable advantage in the analysis of the phosphate of lime. It is true the sulphate of lime is insoluble even in weak alcohol, and can therefore be entirely separated; but whether other phosphates could be decomposed in a similar manner had first to be ascertained by experiment. These were made upon phosphate of magnesia, phosphate of soda, and pyrophosphate of soda. [As the results of the experiments were decidedly unfavourable we omit the details. Professor Rose observes that "it is perfectly evident from these experiments that the complete separation of phosphoric acid from strong bases cannot be effected by sulphuric acid and alcohol even with the addition of a considerable amount of ether."]

In order to separate phosphoric acid from alumina, Rammelsberg decomposes the compound with sulphuric acid, adds sulphate of potash, and separates the alum from the free phosphoric acid by means of alcohol. I have tried this method, substituting sulphate of ammonia for the sulphate of potash, in order, when alkalis are present, to obtain these also separated from the phosphoric acid.

Experiments were made on phosphate of alumina, when 48.93 per cent. was obtained instead of 41.84 alumina. Phosphate of iron was then tried; but, instead of 52.31 per cent., 55.18 per cent. of peroxide of iron was obtained, which, dissolved in muriatic acid, mixed with tartaric acid and sulphate of magnesia and chloride of ammonium, gave a considerable precipitate of ammonio-phosphate of magnesia on supersaturating with ammonia. In a second slightly modified experiment a less amount of peroxide of iron than was required by theory was obtained; but even that was not free from phosphoric acid. Neither the phosphate of alumina nor the phosphate of iron can be accurately separated according to the above method. But since the sulphate of potash and the sulphate of ammonia form a series of double salts with several other sulphates, which might perhaps resist more completely the solvent action of the alcohol than the latter alone, an attempt was made to decompose the phosphate of magnesia according to this plan. But here only 39.37 per cent. of phosphoric acid were obtained instead of 63.36; the enormous loss was owing to the phosphoric acid having escaped with the vapours of the sulphuric acid. As, however, in this experiment the amount of magnesia was obtained with tolerable accuracy, the experiment was repeated. 1.578 grm. phosphate of magnesia was heated with concentrated sulphuric acid at a very gentle heat; an equal amount of sulphate of ammonia then added, and again heated very gently until the mass formed a clear liquid, which formed on cooling a thick syrup. This was dissolved in the smallest possible amount of water at a gentle heat, and the clear liquid poured into a large amount of alcohol of 0.833. After the precipitate had subsided, ether produced only a very slight turbidness in the clear liquid. After standing twelve hours, it was collected on a filter, and washed with a mixture of ether and alcohol. This time it dissolved wholly in water, and the solution did not exhibit the slightest turbidness on the addition of chloride of ammonium and ammonia. On precipitation by phosphate of soda, 1.587 grm. calcined phosphate of magnesia was obtained, which is a trifle above the amount of salt used. It is possible, therefore, to separate magnesia from its combination with phosphoric acid, and to determine its amount accurately, by means of sulphuric acid and the assistance of sulphate of ammonia, ether, and alcohol. But it is not possible to separate alumina and peroxide of iron according to this plan. It must also be observed, that the insoluble residue, consisting of sulphate of magnesia and sulphate of ammonia, must be washed for a very long time with alcohol containing ether, in fact until a few drops of the liquid evaporated on platinum foil do not leave a black ring, disappearing on ignition, which arises from phosphoric acid, the blackening being produced by the action of this acid upon alcohol at an elevated temperature. If this precaution is neglected, the aqueous solution of the residue, insoluble in alcohol, furnishes with chloride of ammonium and ammonia a more or less considerable precipitate or opacity.

But with every precaution the amount of phosphoric acid cannot be determined with accuracy according to this method; for, on applying the most gentle heat to the mixture of phosphate of magnesia and sulphuric acid, some phosphoric acid is always volatilized. On diluting the alcoholic liquid with a large amount of water, adding sulphate of magnesia, chloride of ammonium, and ammonia, only 56.71 instead of 63.36 per cent. of calcined phosphate of magnesia were obtained.

As the separation of magnesia from phosphoric acid succeeded by this method, it was tried for the decomposition of the phosphate of soda; the result, however, was decidedly unfavourable, only 88.21 per cent. being obtained.

All the experiments described prove satisfactorily that it is impossible to obtain the object sought for, that of separating all the bases completely from phosphoric acid, by decomposition with sulphuric acid and alcohol,

An experiment was now made to estimate the acid and bases in a mixture of phosphates by the combination of several methods.

0.348 grm. perphosphate of iron ($Fe_2 O_3 PO_5$), 0.259 grm. phosphate of magnesia ($2MgO, PO_5$), and 0.386 grm. phosphate of lime ($2CaO, PO_5$), were first fused with carbonate of soda, the fused mass treated with water, the insoluble residue collected on a filter, the filtered liquid supersaturated with hydrochlorie acid, and the phosphoric acid then precipitated by sulphate of magnesia, chloride of ammonium, and ammonia. 0.689 grm. calcined phosphate of magnesia was obtained. The insoluble residue was dissolved in hydrochloric acid, the solution mixed with tartaric acid, and supersaturated with ammonia ; a precipitate resulted, which was collected on a filter, washed, and decomposed with concentrated sulphuric acid ; sulphate of ammonia was then added to it, and the whole gently heated. The cold residue was dissolved in as little water as possible and poured into alcohol. The precipitate, washed with alcohol, was dissolved in water, and the solution mixed with ammonia and oxalate of potash ; but no oxalate of lime was precipitated, and only a trace of peroxide of iron, which was collected on a filter. Phosphate of soda produced in the filtered liquid a precipitate of phosphate of magnesia, which after calcination weighed 0.082.

The alcoholic liquid was then mixed with a considerable quantity of water, and exposed to a gentle heat until the alcoholic odour was no longer perceptible; it was then mixed with sulphate of magnesia, chloride of ammonium, and ammonia, when 0.190 grm. of calcined phosphate of magnesia was obtained.

The liquid containing the peroxide of iron dissolved in the tartaric acid was evaporated to dryness, the dry mass heated to redness, and the cinder burnt as much as possible with access of air. The residue was treated with hydrochloric acid, the solution filtered, and precipitated with ammonia ; 0.161 grm. peroxide of iron was obtained.

The filtered liquid was mixed with oxalate of potash, and oxalate of lime precipitated, which, converted into carbonate, contained according to theory 0.159 grm. pure lime.

The liquid separated from the oxalate of lime furnished with phosphate of soda 0.163 grm. calcined phosphate of magnesia.

If we calculate the quantities of the bases and of the phosphoric acid in the phosphates employed, and compare them with those found, we obtain the following results :—

	Calculated.	Found.
Phosphoric acid	54.58	56.18
Peroxide of iron	18.43	16.31
Magnesia	9.56	8.95
Lime	17.33	16.01
	100.00	97.45

The results of this analysis have been communicated merely to show that, notwithstanding the utmost care, only a somewhat approximate result was obtained by this long and tedious method.

SEPARATION OF PHOSPHORIC ACID FROM BASES BY MEANS OF NITRIC ACID AND METALLIC MERCURY.

After all the methods above described had failed in separating phosphoric acid from all bases by a single operation, and even complicated methods had furnished very unsatisfactory results, I succeeded, after many fruitless experiments, in discovering a method which furnishes a result as accurate as it is quick. It is as follows :—The phosphatic compound or the mixture of phosphates is dissolved in nitrie acid. Neither too small nor too large an amount of acid should be employed. The acid solution is then conveyed into a small porcelain dish, but not too small, so that no loss may occur from ejection; and so much metallic mercury then added that at least a small portion is left undissolved by the free acid. Upon this the whole is evaporated in a water-bath to perfect dryness. If the dry mass while warm still smells of nitric acid, this cannot be wholly removed by heating further in the water-bath, which, however, is essentially requisite for the success of the operation. In this case water is added to the dry mass, and the whole again evaporated in the water-bath to perfect dryness. It is frequently advisable to repeat this treatment until the dry mass no longer smells of nitric acid while warm. It is not necessary to add more water than just enough to moisten the dry mass. Cold or hot water is now added, and the whole filtered through a very small filter ; the residue washed with cold or hot water until a few drops of the filtered liquid evaporated upon platinum leave no residue on ignition. In general a very considerable residue is left on evaporation, consisting of protonitrate of mercury ; but this entirely disappears on ignition.

The filtered liquid contains all the bases which had been combined with the phosphorie acid united with nitric acid, along with a considerable quantity of protonitrate of mercury and some pernitrate : hydrochloric acid is added to it. If the precipitate it produces is very considerable, it is collected upon a filter and washed. On ignition the protochloride of mercury leaves no residue ; if, on the other hand, the precipitate is but small, ammonia may be added immediately to the liquid ; there is then formed a black precipitate, and a white one consisting of perchloride of mercury and amidogen. However, this method can only be applied when there are no bases present which are precipitated by ammonia. The precipitate frequently contains some peroxide of iron. The precipitate must be quickly filtered and washed, protected from access of air, in order that no carbonate of lime may separate if this base be present. When magnesia is present, it is advisable to add some chloride of ammonium to the liquid, to prevent its being precipitated by the ammonia. If the decomposition has been perfectly effected, the precipitate produced by ammonia, which is frequently very considerable, leaves on ignition only a few milligrammes of peroxide of iron ; but sometimes a considerable residue, amounting to several decigrammes, is left. In that case the decomposition has not been complete, or the whole of the free nitric acid not expelled. It is also possible that too little nitrie acid was employed to dissolve the phosphatic compounds, so that there was not sufficient protoxide of mercury formed to separate entirely the phosphoric acid. This residue usually consists of phosphate of magnesia and peroxide of iron.

In all cases it is advisable not to throw away the washed mercurial precipitate, but to calcine it after desiccation, in order to submit the residue to examination. If it consist of earthy phosphates, the treatment with mercury and nitrie acid must be repeated. If it consist solely of carbonate of lime or of magnesia, it is only requisite to dissolve it in hydrochloric acid, and to add it to the liquid separated from the precipitate produced by ammonia. As sometimes earthy phosphates may be contained in the precipitate, oxalie acid must not be added immediately after the precipitation by ammonia, for the purpose of throwing down the lime.

It is unnecessary to observe that the precipitate should be heated to redness under a chimney with a strong draught, that no injury may arise from the mercurial vapours.

The alkalis, lime, magnesia, and other metallic oxides contained in the liquid filtered from the precipitate, are separated by the usual methods.

The mercury may likewise be removed from the solution of the nitrates by evaporating the solution in a platinum dish, and exposing the residue to a red heat in a platinum crucible. In many cases this method is more simple and advantageous. The large amount of ammoniacal salts introduced in order to remove the mercury, the expulsion of which is connected with much inconvenience, is avoided. It should, however, be observed that, when alkaline nitrates are present, the dry residue on ignition must be mixed with a small quantity of dry carbonate of ammonia, in order to convert into carbonates the free alkalis produced by the decomposition of the nitrates. If this precaution is neglected, the platinum crucible is very much acted upon. The calcined residue is dissolved in dilute hydrochloric acid, and the bases separated in the usual manner.

We now come to the determination of the phosphoric acid in the residue insoluble in water. This contains protophosphate of mercury, protonitrate and metallic mercury. A certain amount of persalt has been formed from the protosalt by the treatment with water ; and, if the washing has been long continued with hot water, merely oxide is obtained.

The following method of determining the phosphorie acid in this residue has been found from long experience to be the best. The filter with the mercurial salts is well dried ; the latter shaken from the filter into a platinum crucible, and mixed with an excess of carbonate of soda, or, what is better, a mixture of carbonate of potash and carbonate of soda, as a less heat is then required to fuse the mass. A little hollow is now made in the mixture ; the filter rolled up into a little ball and placed in the hollow, covered with the mixture, and over the whole is spread a layer of carbonate of soda. The crucible is then exposed for about half an hour under a chimney with a good draught to a moderate but not red heat, that the contents may not fuse. At this temperature the whole of the metallic mercury and the mercurial salts, with the exception of the protophosphate, are expelled. The strongest heat to be obtained with an Argand lamp and strong spirit is now applied ; there is no need to fear any boiling over, as the mass has been considerably diminished in bulk by the first heating. The fused mass is treated with hot water, in which it dissolves entirely if the operation has been conducted with care and no iron was contained in the compound. It is supersaturated with hydrochlorie acid, and then sulphate of magnesia, chloride of ammonium, and ammonia added to precipitate the phosphoric acid in the usual manner.

The above plan should be carefully adhered to in heating the mixture of the mercurial salts with the alkaline carbonates, otherwise a false result is frequently obtained ; for instance, if the filter and its contents were not perfectly dry before being mixed with the dry alkaline carbonates, or if too great a heat was applied at the commencement, the mass froths very considerably ; whilst, when the mixture is perfectly dry, the protonitrate of mercury is expelled at a gentle heat, without acting upon the carbonate of soda. Moisture and a strong heat produce decomposition with violent effervescence ; the nitrate of soda produced is decomposed at a higher temperature, and acts violently on the platinum crucible ; oxide of platinum is formed, and the crucible is found to have decreased some centigrammes, and frequently even some decigrammes, in weight. A brown powder is left on solution in water, which dissolves very sparingly in muriatic acid. It is washed with pure water, when no oxide of iron is contained in the substance examined.

When mercurial salts are heated alone in the platinum crucible without being mixed with carbonated alkali, there remains after the ignition a glass of phosphorie acid, which, curiously enough, always retains some mercury, even when the crucible has been exposed to a very intense heat.

The following precautions should not be neglected. So much metallic mercury should be added to the solution of the substance in nitric acid that a tolerable quantity of globules of mercury are distinctly perceptible in the dry mass. If this is not the case, mercury and water should be added, and the whole again evaporated in the water-bath. It is essentially requisite to the success of the experiment that the evaporation should be made on a water-bath ; for if the temperature should have exceeded that of boiling water, even for a very short time, a certain amount of the nitrates may have been decomposed and some nitric acid been lost. The basic nitrate of mercury or the oxide will then be left

undissolved along with the protophosphate of mercury in the treatment with water. But none of the nitrates with strong bases are decomposed at the temperature of boiling water.

All the compounds of phosphoric acid can be so perfectly decomposed by this method, that on the one hand we obtain the bases free from every trace of phosphoric acid, and on the other the phosphoric acid free from any traces of the bases with which it had been combined, which is not possible by any other method. All bases form with nitric acid soluble neutral salts, and can consequently be completely separated by water from the insoluble protophosphate of mercury.

When weak bases are present the treatment must be slightly modified. This refers especially to the phosphate of iron and phosphate of alumina. The combinations of these bases with nitric acid cannot be evaporated in the water-bath without parting with a portion of their acid, and become for the greater part insoluble in water. Iron very frequently occurs in the ashes of organic substances; but it is remarkable that hitherto alumina has not been detected in them, at least not with certainty. The modification which the presence of iron requires is not considerable; but the presence of alumina renders the method far more complicated.

When phosphates containing iron are evaporated as described, with nitric acid and mercury, the greater portion of the peroxide of iron is left on treating the dry residue with water with the protophosphate of mercury, and only a small portion dissolves with the nitrates; it is filtered and washed in the usual way, the peroxide of iron in the solution determined with the other bases, and the insoluble portion fused with carbonate of soda. On treating the fused mass with water, the peroxide of iron is obtained perfectly free from phosphoric acid, whilst the entire amount of phosphoric acid in combination with soda is dissolved.

When the fusion with carbonate of soda has been effected with the precautions above described, the peroxide of iron dissolves in muriatic acid without any residue, and can be precipitated from the solution by ammonia. Sometimes, however, when too great a heat has been employed at the commencement, a reddish-brown powder is left, which even after long digestion in hydrochloric acid remains undissolved, and consists of oxide of platinum. A small portion, however, dissolves with the peroxide of iron in the acid. Notwithstanding the presence of platinum, the iron may be accurately precipitated by ammonia without the precipitate containing any platinum, only it is requisite to employ a somewhat large amount of ammonia; the precipitate then is of a pure reddish dark-brown colour, and the ammonio-chloride of platinum is dissolved in the excess of ammonia. The liquid filtered from the iron is colourless, and gives with sulphuret of ammonium a blood-red precipitate soluble in a large excess of the precipitant.

When phosphate of alumina is present the investigation becomes more complicated. Although the phosphoric acid can be perfectly separated by nitric acid and mercury, the nitrate of alumina is decomposed like the nitrate of iron by the heat of the water-bath, only less easily. 1.030 grm. phosphate of alumina, $Al_2 O_3 PO_5$, was treated with nitric acid and mercury, and the dry residue exhausted with water; the liquid passed turbid through the filter, which is not the case with iron; it was, therefore, filtered again, and the amount of alumina determined in it. Only 0.272 grm., or 26.40 per cent., was obtained instead of 41.84.

Since the phosphate of alumina cannot be decomposed by fusion with carbonate of soda, silicic acid must be added on fusion, and the separation effected in the usual manner. Excepting the phosphate of alumina, all the other phosphates, at least those which occur most frequently, can be decomposed more readily and completely than is possible by any other method. I have not enumerated any analyses to support this assertion; but during three years, since I introduced this method in my laboratory, a very large number of compounds of phosphoric acid, especially such as are contained in the ashes of organic substances, have been examined by me, by M. Weber, and by several other young chemists, with the most favourable results.

I have on that account not made further experiments on some other methods which have been proposed for the decomposition of phosphatic compounds, and especially on that of Schulze, for separating the compounds of phosphoric acid with peroxide of iron, alumina, and lead from other phosphates by acetic acid, since this method requires great precaution in using it, and frequently leads to incorrect results.

After I had written this paper I became acquainted with Fresenius's experiments on the same subject. I am, therefore, not able to enter into a minute criticism of his method; I must, however, observe, that his experience is in contradiction to mine as to the phosphate of iron not being completely decomposed by fusion with carbonated alkali. Not only earlier, but even very recent, experiments made in my laboratory, besides those mentioned in this paper, have demonstrated that the decomposition is complete.—*Poggendorff's Annalen*, March, 1849.

ON CIRCULAR MAGNETIC POLARIZATION.

By M. A. BERTIN.

[*Continued from page* 89.]

Let us now examine the various circumstances which cause the magnitude of the rotation to differ.

The nature of the bodies should rank first. The differences are considerable in the various kinds of glasses; they are less perceptible in liquids, and, indeed, according to some experimenters, all solutions have the same rotatory power. Thus Professor Faraday (in 2185 of his memoir) considers as probable that, in aqueous solutions, the [ruling] rotative matter is the water, and not the other substance. But this opinion will no longer be entertained when we observe, in the first place, that the most energetic liquids are precisely those which are anhydrous; and, secondly, that among the dissolved bodies there are some which increase the rotatory power of the water, and others that diminish it. Moreover, on increasing the proportion of water in one and the same solution, the rotatory power is seen gradually to approach to that of pure water,—a conclusive proof of the influence of the substance in solution. Alcoholic solutions lead to the same result.

I will here enumerate a few of the numerous experiments made on this subject. The concentration represented by 1 is that of the most saturated solution; $\frac{1}{2}$ represents the degree of concentration of the same solution diluted with water, and so on.

1. ROTATIONS PRODUCED BY SOME ANHYDROUS LIQUIDS.

Name of liquid.	Thickness. Centim.	Rotations. ° ′	Rotation of water. ° ′
Bichloride of tin	1	7 30	2 20
Sulphuret of carbon .. .	1	7 00	2 20
Sulphuret of carbon ...	8	14 5	4 30
Protochloride of phosphorus	1	5 00	2 20

2. ROTATIONS PRODUCED BY SOME AQUEOUS SOLUTIONS.

Name of liquid.	Concentration.	Thickness. Centim.	Rotations. ° ′
Chloride of calcium.....	1	13	6 20
Chloride of calcium....	$\frac{1}{2}$	..	4 55
Chloride of calcium....	$\frac{1}{4}$	..	4 40
Chloride of calcium....	$\frac{1}{8}$	..	4 00
Water	..	..	3 40
Chloride of magnesium	1	..	6 5
Chloride of magnesium	$\frac{1}{2}$	..	5 30
Chloride of magnesium	$\frac{1}{8}$	..	4 5
Water	..	..	3 30
Chloride of zinc.....	..	8	10 00
Water	..	..	4 30
Chloride of strontium. . ..	..	5 30	
Water	..	4 15	
Nitrate of ammonia.... ..	13	3 45	
Water	..	4 55	
Sulphate of iron	..	4 20	
Water	..	6 00	

3. ROTATIONS PRODUCED BY ALCOHOLIC SOLUTIONS.

Chloride of magnesium ..	13	3 20
Chloride of strontium. . ..	..	3 50
Alcohol of 36° Beaumé ..	..	3 00
Distilled water..... ..	..	4 15

The rotatory power of sulphuret of carbon is remarkable; it is three times greater than that of water, and only twice less than that of the flint-glass of Faraday. This liquid is consequently valuable, because it may be substituted for the majority of the rare glasses required for this class of experiments. In the same substance the rotation varies in intensity with the thickness; but the law which regulates this variation has been differently expressed by the various experimenters who have studied this subject. Some have stated that the rotation was proportional to the thickness; others that it was independent of it; and others, again, that it increased with the thickness up to a certain limit, from which it diminished, and was finally reduced to zero. It is easily seen how much is true and how much is erroneous in these assertions.

In the first place it is evident that, if we consider the action of a single pole on a substance of indefinite length, this action, variable with the distance, will decrease from the first layer to the second, from the second to the third, to a certain distance, beyond which it will be null; so that the more distant layers will no longer be acted upon by the magnetism. The effects upon all the successive layers being added together, it will be seen that, if we submit to the influence of a single pole increasing thicknesses of the same substance, the rotation will increase with the thickness up to a certain point, beyond which it will remain constant, an increase of thickness only producing layers which are no longer influenced.

It is likewise evident that, if the substance is submitted to the contact action of two poles of constant equal force, the effects will only be doubled, and that in consequence the law will still be the same.

But, on interposing fresh strata between the poles, it becomes requisite to separate them more and more, which somewhat diminishes their intensity by decreasing the influence which they exert one on the other. Three cases may then occur: either this diminution of intensity will compensate the effect produced by the increase of thickness, or it will have a more feeble influence, or, lastly, it will preponderate.

In the first case the rotation will be independent of the thickness; in the second it will increase with the thickness up to a certain point, beyond which it will remain constant; and lastly, on the third hypothesis, it will attain a maximum, beyond which it will decrease, but without returning to zero, the two poles always producing effects which conjoin, so that the extent of the rotations will be twice the effect produced by a single pole.

It will be seen from the following table that the two first cases may occur with M. Becquerel's electro-magnet, where the variation of the poles of the keepers must be considerable.

Substances experimented with.	Thickness. mm.	Rotations. ° ′
Flint-glass of Faraday	18.3	18 20
Flint-glass of Faraday	48.3	25 5
Very thick flint-glass	55.1	22 30
Very thick flint-glass	110.3	23 30
Distilled water	10.0	2 00
Distilled water	20.0	3 30
Distilled water	30.0	4 20
Distilled water	80.0	4 30
Distilled water	130.0	5 00
Distilled water	155.0	5 00

If, instead of always bringing the poles in con-

tact with the magnetized substance, they are left at the same distance, by placing between them a gradually increasing number of strata, the rotation will be seen to increase in a continuous manner until the thickness is equal to the distance of the poles. Again, if these poles are sufficiently removed from the various strata of the substance, so that the variations of their distance do not produce perceptible variations in their rotations, the action will be equal upon all, and the rotation observed will be proportional to the thickness of the substance. This, in fact, is the law discovered by Prof. Faraday, on employing horseshoe electro-magnets not furnished with keepers.

The law of the variations with the thickness is evidently connected with that of the variations with the distance; but this is not better known than the first. It is, therefore, to the simultaneous examination of these two laws that my attention was necessarily directed.

LAW OF THE THICKNESS AND OF THE DISTANCE.

The action of the two reels or coils of the apparatus being no more than the sum of the rotations produced by each of them, I had at first, in order to simplify the problem, to study the action of a single coil upon a substance of known thickness, placed upon the axis at a fixed distance.

Action of a Single Pole.—One of the coils being removed, I placed the flint-glass upon which I wished to experiment in contact with the remaining coil, then I removed it a certain distance, which I valued by the passage of its support over a divided scale. Now, on increasing the distance of the flint-glass from the coil in arithmetical progression, the rotations of the plane of polarization decrease in geometrical progression. In proof of this I will enumerate only three series of experiments in which I varied the distances; at first 1 millimetre, then 5 millimetres, and lastly 10 millimetres. The relations of the successive rotations are:—

In the first case..... $0.97587 = r^1$,
In the second case.... $0.88504 = r^5$,
In the third case .... $0.78233 = r^{10}$.

1. EXPERIMENTS WITH THE FLINT-GLASS OF MR. FARADAY, THICKNESS 38.9 MILLIMS.

Distance from the flint glass to the coil. x.	Rotation observed. y.	Relation of the Rotations. $\frac{y'}{y}$	Calculated Rotation. $y_1' = y.0.97587$.	Difference. $y_1' - y'$.
	° ′		° ′	′
0	11 12	..	0 00	— 4
1	11 00	0.9821	10 56	+19
2	10 26	0.9470	10 44	—10
3	10 7	0.9712	9 57	+ 1
4	9 50	0.9719	9 51	+ 5
5	9 30	0.9661	9 35	— 4
6	9 20	0.9824	9 16	—17
7	8 47	0.9417	9 4	— 1
8	8·35	0.9772	8 34	+ 2
9	8 20	0.9709	8 22	+11
10	7 55	0.9508	8 6	
0	9 50			

2. EXPERIMENTS WITH THE FLINT-GLASS OF MR. FARADAY, THICKNESS 38.9 MILLIMS.

Distance from the flint glass to the coil. x.	Rotation observed. y.	Relation of the Rotations. $\frac{y'}{y}$	Calculated Rotation. $y_1' = y.0.88504$.	Difference. $y_1' - y'$.
	° ′		° ′	
0	12 30	..	0 00	
5	11 10	0.8934	11 4	— 6
10	9 35	0.8582	9 54	+19
15	8 30	0.8870	8 30	
20	7 25	0.8726	8 31	+ 6
25	6 35	0.8876	6 33	— 2
30	5 45	0.8735	5 50	+ 5
35	5 5	0.8840	5 5	
40	4 35	0.9016	4 31	— 4
45	4 00	0.8728	4 4	+ 4
50	3 35	0.8957	3 32	— 3

3. EXPERIMENTS WITH THE FLINT-GLASS OF MATTHIESSEN, THICKNESS 44 MILLIMETRES.

Distance from the flint glass to the coil. x.	Rotation observed. y.	Relation of the Rotations. $\frac{y'}{y}$	Calculated Rotation. $y_1' = y.0.78233$.	Difference. $y_1' - y'$.
	° ′		° ′	
0	7 40	..	0 00	
10	6 20	0.8261	6 1	—19
20	5 00	0.7895	4 56	— 4
30	3 40	0.7333	3 53	+14
40	2 50	0.7727	2 53	+ 3

This law may be represented by a very simple formula. On expressing by A the rotation produced by the flint-glass in contact with the coil, if Ar is the rotation produced by the same flint-glass at the distance of one millimetre, the action of the coil at a distance x millimetres will be $y = Ar^x$.

This formula proving true for all thicknesses, it must be concluded that it represents the elementary action of a pole upon any stratum whatsoever; for instance, upon a stratum of one millimetre. It may consequently lead us to the law connecting the rotation with thickness, if, in every instance, each of the different sections of a substance receives an impression as if it were a single one. To convince myself of this, I placed two flint-glasses in contact between the two poles in certain positions, and observed the rotations produced by the two flint-glasses collectively, and by each of them singly, in the position which it first occupied.

The following experiments show that the first rotation is always the sum of the two others:—

Flint-glass in Juxtaposition.	Rotations Produced. By the Flint-glasses separately.	Rotations Produced. By the Sum of the Two Flint-glasses.	Difference between the Third and the Sum of the Two First.
	° ′	° ′	′
Flint-glass of Faraday of 18.3	8 10	25 10	— 5
Ditto 38.9	17 5		
Ditto 38.9	12 12	26 10	—14
Ditto 48.3	14 12		
Ditto 38.9	12 32		
Flint-glass of M. Matthiessen of . 44.0	11 20	24 10	+18
Flint-glass of Faraday 38.9	12 15	19 32	+12
Common flint-glass of 43.5	7 5		
Experiment with a Single Pole.			
Flint-glass of Faraday of 18.3	5 35	12 55	+10
Ditto 38.9	7 10		

Thus the action of a pole upon any section whatever of a substance depends solely on the distance of this section from the pole, and according to a known law. If, then, in a thickness of e millimetres, we consider e sections of one millimetre, and represent by c the rotation which each of these sections would produce if it were in contact with the pole, the rotation produced on contact by the thickness e will be the sum of the terms of a geometrical progression, the first term of which is c, the cause r, and the number of the terms e; that is to say, we shall have

$$A = c\frac{1-r^e}{1-r},$$

whence

$$y = c\left(\frac{1-r^e}{1-r}\right)r^x.$$

This formula represents the general action of a single pole. It may be proved by comparing the rotations observed at the same distance x by two thicknesses e and e' of the same flint-glass; for, if y and y' represent the two rotations observed, it is evident that we ought to have

$$\frac{y'}{y} = \frac{1-r^{e'}}{1-r^e},$$

and we are able to compare this rotation with that given by experiment. This comparison confirms the accuracy of the formula, as will be seen by Table I.

Action of the Two Poles of the Apparatus.—The formula $y = Ar^x$, which represents the action of a single coil, gives us also that of two electro-magnetic coils facing each other with the poles of opposite names, as in the case of our apparatus. If, in fact, these two coils are at a distance d, the flint-glass of e thickness, placed at a distance x from the first, will be distant $d-e-x$ from the second; and, as the two actions add to each other, the total rotation will be

$$z = c\left(\frac{1-r^e}{1-r}\right)(r^x + r^{d-e-x}).$$

Even the form of this expression shows that if we only vary the distance x in taking three consecutive rotations z, z', z'', observed in the same flint-glass placed successively at the distances x, $x+a$, $x+2a$, the sum of the two extreme rotations will be to the intermediary rotation in a fixed relation equal to $r^a + r^{-a}$; that is to say, that

$$\frac{z+z''}{z'} = r^a + r^{-a}.$$

This conclusion is confirmed by experiment, as is seen in the following tables:—

1. EXPERIMENT WITH SULPHURET OF CARBON, $e=41.1$ $d=77$.

Distance. x.	Rotation. z.	Relation. $\frac{z+z''}{z'}$.	Calculated Rotation. $z'_1 = \frac{z+z''}{2.06}$.	Difference. $z'_1 - z'$.
	° ′		° ″	′
5	6 00	..	6 00	0
15	5 00	2.08	5 3	+3
25	4 25	2.08	4 27	+2
35	4 10	2.02	4 7	—3
45	4 5	2.07	4 7	+2
55	4 20	2.06	4 19	—1
65	4 50	2.03	4 46	—4
75	5 30	Mean 2.06		

2. EXPERIMENT WITH THE FLINT-GLASS OF MR. FARADAY, $e=48.3$ $d=125$.

	° ′		° ′	′
0	9 40	..	9 40	0
10	8 25	2.04	8 20	— 3
20	7 35	2.02	7 36	+ 1
30	6 45	2.06	6 47	+ 2
40	6 25	2.06	6 26	+ 1
50	6 30	2.14	6 45	+15
60	7 30		7 15	
50	..	Mean 2.06	6 39	
40	6 25	..	6 25	0
30	..	..	6 28	
20	6 55	..	6 55	0
10	..	..	7 38	
0	8 50	..	8 39	—11

The rotations compared being here more considerable, I have deduced the value of r from the equation

$$r^{10} + r^{-10} = 2.06,$$

whence

$$r = 0.97587.$$

The numbers compared with the experiments in the preceding tables have all been calculated with this value of r.

The general formula also furnishes us with another series of proofs. If we vary merely the thickness of the flint-glass by placing it in contact with one of the coils, we shall obtain as the relation of two rotations z and z', produced by two thicknesses e and e',

$$\frac{z'}{z}=\left(\frac{1-r^{e'}}{1-r^{e}}\right)\left(\frac{1+\frac{r^{d}}{r^{e'}}}{1+\frac{r^{d}}{r^{e}}}\right).$$

In Table II. (which see) is shown the comparison of the results calculated in this manner with those furnished by experiment.

This comparison is the last verification which can be made of our formula. We might, it is true, vary d, and then, as $x=0$, we have

$$z=A(1+r^{d-e}),$$

or,

$$z-A=\frac{A}{r^{e}}r^{d}.$$

We conclude that the quantity $z-A$ ought to decrease in geometrical progression as the distance of the poles increases in arithmetical progression. But experiment no longer confirms this conclusion, which is owing to the coefficient A no longer being constant, but varying with the distance of the poles; for these, by reacting one upon the other, change the intensity of their magnetism. If this reaction did not take place, the action of the two poles in contact with the flint-glass would be twice the action of a single one, whilst it is much stronger. In one experiment, for example, it was 28° 10′ in the first case, and only 12° 30′ when one of the coils was removed.

To sum up, we may state that the rotation produced by the two coils of our apparatus is represented by the formula

$$z=c\left(\frac{1-r^{e}}{1-r}\right)(r^{e}+r^{d-e-x}),$$

which gives the action of a single coil in making $d=\infty$.

In this formula r appears neither to depend on the intensity of the magnetism nor on the nature of the substance. As to c, it depends on both; but it remains constant in all the experiments compared, because they were always made at very short intervals, and, moreover, upon the same substance, and with the same distance between the poles.

It would undoubtedly be curious to ascertain why c varies with the intensity of the magnetism; but it may already be said that the law is the same for all substances; so that the relations of the rotations produced by these substances do not depend on the force of the magnetism, as may be seen by the following experiment made with M. Becquerel's electro-magnet:—

Flint-glass of Mr. Faraday of 18.3 millimetres.	Sulphuret of Carbon of 10 millims.	Relation between the Rotations.
° ′	° ′	
7 42	3 18	0.43
13 48	6 00	0.43
19 00	8 18	0.43

Three other experiments made with M. Ruhmkorff's apparatus gave:—

	° ′	° ′	° ′
For Faraday's flint-glass...	27 30	16 25	13 40
For Matthiessen's flint-glass	21 40	13 40	10 30
For common flint-glass....	13 45	8 50	6 45

And in these three series the rotation of the flint-glass of M. Matthiessen remained nearly equal to 0.8, and that of the common flint-glass equal to 0.5 of the rotation produced by the flint-glass of Professor Faraday.

For this reason I propose to call c the coefficient of magnetic polarization. The value is calculated by comparing two rotations observed at short intervals upon two substances placed under certain circumstances, but always between two poles at the same distance, that is to say, by deducing the value of c from the equations which give y or z. We shall have, for example, for $x=0$,

$$\frac{c'}{c}=\frac{y'}{y}.\frac{1-r^{e}}{1-r^{e'}},$$

or

$$\frac{c'}{c}=\frac{z'}{z}.\frac{1-r^{e}}{1-r^{e'}}.\frac{1+r^{d-e}}{1+r^{d-e'}}.$$

Table I.

Name of the Flint-glass.	Distance. x.	Thickness. e.	Rotation. y.	Relation of the Rotations. $\frac{y'}{y}$.	Calculated Relation. $\frac{1-re'}{1-re}$.	Calculated Rotation. y_1.	Difference. y_1-y.
			° ′			° ′	′
Flint-glass of Mr. Faraday	0	48.3	9 55	1.951	1.916	9 51	— 4
	..	18.3	5 5	1	1	5 9	+ 4
Flint-glass of Mr. Faraday	0	18.3	4 47	1	1	4 54	— 7
	..	48.3	8 50	1.847	1.916	9 23	+33
	..	38.9	8 10	1.704	1.697	8 19	+ 9
	..	57.2	10 30	2.195	2.082	10 12	—18
	..	87.2	11 50	2.474	2.438	11 57	+ 7
Flint-glass of Mr. Faraday	13.3	18.3	3 25	1	1	3 19	— 6
	..	48.3	6 10	1.823	1.916	6 16	+ 6
	..	38.9	6 00	1.756	1.697	5 36	—24
	..	57.2	7 20	2.146	2.082	6 52	—28
	..	87.2	8 10	2.390	2.438	8 24	+14
Flint-glass of M. Matthiessen ..	0	44.0	7 57	2.695	2.374	7 40	—17
	..	13.3	2 57	1	1	3 14	+17
Flint-glass of M. Matthiessen ..	0	44.0	7 0	2.540	2.374	6 51	— 9
	..	13.3	2 45	1	1	2 54	+ 9
Common flint-glass	0	43.3	4 25	2.210	2.190	4 24	— 1
	..	14.5	2 0	1	1	2 1	+ 1

Table II.

Name of Flint-glass.	d.	Thickness. e.	Rotation. z.	Relation. $\frac{z'}{z}$.	Calculated Relation.	Calculated Rotation. z_1.	Difference. z_1-z.
			° ′			° ′	′
Faraday's flint-glass.....	48.3	48 3	22 12	2.537	2.587	22 19	+ 7
	..	18.3	8 45	1	1	8 38	— 7
Ditto	48.3	48 3	21 45	2.534	2.587	21 57	+12
	..	18.3	8 35	1	1	8 23	—12
Ditto	57.2	57.2	25 10	3.073	3.014	25 19	+ 9
	..	38.9	17 5	2.086	2.002	16 49	—16
	..	18.3	8 10	1	1	8 24	+14
Ditto	73.0	48.3	12 45	2.390	2.350	12 40	— 5
	..	18.3	5 20	1	1	5 25	+ 5
Ditto.....	77.0	48.3	12 45	2.250	2.314	12 52	+ 7
	..	18.3	5 40	1	1	5 33	— 7
Ditto	87.2	87.2	26 10	2.147	2.197	26 8	— 2
	..	48.3	14 12	1.164	1.204	14 20	+ 8
	..	38.9	12 12	1	1	11 56	—16
Ditto	110.3	48.3	11 20	2.261	2.113	11 10	—10
	..	18.3	5 5	1	1	5 15	+10
Matthiessen's flint-glass.....	44.0	44.0	17 30	3.365	3.226	17 18	—12
	..	13.3	5 12	1	1	5 24	+12
Ditto	48.3	44.0	16 20	3.322	3.165	16 8	—12
	..	13.3	4 55	1	1	5 7	+12
Ditto	77.0	44.0	10 10	2.652	2.836	10 21	+11
	..	13.3	3 50	1	1	3 39	—11
Common flint-glass	48.3	43.3	10 25	2.841	2.869	10 28	+ 3
	..	14.5	3 40	1	1	3 37	— 3
Ditto	73.0	43.3	6 10	2.400	2.620	6 20	+10
	..	14.5	2 35	1	1	2 25	—10
Ditto	110.3	43.3	5 20	2.667	2.385	5 13	— 7
	..	14.5	2 0	1	1	2 7	+ 7

The following table has been formed in this manner. It contains the coefficients of magnetic polarization of the different substances experimented with, compared with the flint-glass of Prof. Faraday:—

Faraday's flint-glass	1.00
Guinant's flint-glass	0.87
Matthiessen's flint-glass.....	0.83
Very thick flint-glass (from the Conservatoire)	0.55
Common flint-glass	0.53
Bichloride of tin.....	0.77
Sulphuret of carbon	0.74
Protochloride of phosphorus.....	0.51
Chloride of zinc dissolved.....	0.55
Chloride of calcium dissolved.....	0.45
Water	0.25
Ordinary alcohol of 36° Beaumé..	0.18
Ether	0.15

I ought not to conclude without remarking, that all the preceding experiments merely relate to the action of electro-magnets upon exterior substances. When the flint-glass experimented with, instead of being outside the electro-magnetic coil, was placed in the interior, I did not observe the rotation. I have noticed a very faint one when the second coil was brought near to the first; but this action was very considerably less than that which this second coil would have produced upon the same flint-glass placed at the same distance externally. These negative experiments are not opposed to those of Professor Faraday, for they were not made under the same circumstances.

If Professor Faraday has observed a rotation in flint-glasses placed in helices, still it was very faint; again, the interposition of iron nuclei only increased it when they were longer than the helix; and lastly, this interposition disminished, on the contrary, the rotation when the interior iron cylinder, having the same length as the helix, had at the same time a convenient thick-

ness (§ 2209 of his memoir). Thus in a helix of 673 millimetres in length, of 121 millimetres in external diameter, and of 63 millimetres internal diameter, the insertion of an iron nucleus of 9 millimetres in thickness diminished the rotation of the substances placed in the interior. In my experiments I have never made use of coils enclosing such thin iron cylinders; the thickness of these cylinders was not less than 25 millimetres; their length was moreover always equal to that of the external helix.

ON THE ELECTRIC LIGHT.

By Mr. JONATHAN WILKINSON.

[From "The Pharmaceutical Journal."]

Will you allow me to make a few observations on a statement or two in the communication of Dr. Letheby in your last number,* on the experiments made at Devonport with the view of testing the power of the electric light?

It is stated that "when Mr. Hearder turned the mirror so as to throw the light towards Bovisand, which was at a distance of 16,470 feet from the column, a candle, six in the pound, projected a similar shadow at thirty feet distance; that is to say, the shadow projected by the electric light at a distance of 16,470 feet was equal to that cast by the candle at thirty feet; consequently, their relative illuminating powers are as 301,401 to 1." Now, I believe this to be an error that may be attributed to the haste in which the facts were put together; for you will observe that a mirror was used with the electric light, which had the effect, "when turned towards the clouds, of reflecting the rays of light in the form of the tail of a huge comet, the reflector being the nucleus," or, in other words, in the form of a cone, the apex of which was the reflector, and the base the cloud or place illuminated.

The error consists in measuring the electric light thrown from the mirror in the form of a comet's tail, in the same manner as the light of the candle, which was not concentrated and reflected, but allowed to diverge in every direction.

The lights ought to be without reflectors, when the squares of their distances are taken as their illuminating powers.

From the experiments I have made and am now making with the electric light, I see no reason to doubt Professor Grove's statement respecting the power of the light he then produced. It may be stated thus:—1,444 mould candles, six in the pound, will weigh 240½ pounds, costing at 7d., without the fraction, £7, which will burn on an average nine hours and a half—equal to 14s. 9d. per hour for candles, to produce the same amount of light as the electric light he produced, costing, I believe, 2s. per hour. The light said to be obtained at Devonport would be nearly 209 times as intense as Professor Grove's; the same amount of light from candles would cost £150 per hour!

I am induced to make these few remarks because I think it is not necessary to have anything but the truth stated, to place the electric light amongst the most extraordinary applications of science that have been made in our time; for when we see a light so small, pure, and brilliant, which may be enclosed in an air-tight glass vessel whose cubical contents need not be more than a pint, and therefore perfectly innoxious to the atmosphere, producing, at a cost of 2s. per hour, a light equal to 1,444 candles, which cost 14s. 9d. per hour, consuming or altering as much of the surrounding atmosphere as so many persons, we surely require nothing more to satisfy us but the means of continuing such a light for any time it may be required; and I hope the time is not far distant when the public will be put in possession of the electric light in such a state as to be economical and applicable to many useful purposes.

Grimesthorpe, near Sheffield,
July 16, 1849.

[We have received a communication on this subject from Dr. Letheby, who requests us to correct the error, and observes, that he had at first imagined that the candle as well as the electric light had been focused by a reflector, which was also our impression on first reading the paper. It appears, however, that this was not the case. The circumstance, while it affects the numerical value of the result, cannot influence the general character of the experiments, which were made, not so much for the purpose of arriving at an accurate estimate of the intensity of the electric light, as with the view of ascertaining its general capabilities. Dr. Letheby, who favoured us with the report, was not present at the experiments, which may account for the error.—Ed.]

* Vide *Chemical Time*, page 55 of the present volume.

THE CHEMICAL TIMES.

SATURDAY, AUGUST 4, 1849.

THE VENTILATION OF SEWERS.

In our two last articles on this most important subject we entered into a consideration of that part of the sewerage question which has reference to the disposal of the noxious gases generated during putrefaction. We believe we have clearly shown how, by adopting Mr. Coxworthy's plans, these noxious gases may be got rid of by simple and natural means, and without having recourse to fires, steam-jets, or other artificial means, which, even if practicable—which most of them are not—necessarily involve the application of engines and other mechanical contrivances, requiring constant supervision and frequent repairs, and entailing thus an everlasting expense upon the public. Besides, the working of these artificial appliances increases the consumption of coal, which already reaches in this country the enormous bulk of thirty-five million tons annually, and which, on philosophical grounds—as we shall hereafter be able to show—it is highly desirable should be checked as much as possible.

That our strong condemnation of the present highly pernicious system of ventilation, first introduced by the City commission, and subsequently adopted by the metropolitan board, is admitted to be just, is clearly shown from the fact that a great number of foul-air escapes in the City have been closed since the appearance of the cholera. The satisfaction which this affords us is considerably heightened by the positive conviction which we entertain that the closing of these foul-air escapes in some localities will, by further concentrating the gases, aggravate the nuisance in other localities to such a pitch that the total abolition of the system, and substitution of a more rational one, must speedily follow—except, indeed, the City commissioners choose to follow the bright example set them by their metropolitan brethren, and to stop up the holes in front of those houses only of which the proprietors or tenants have sufficient influence to make their complaints heard, leaving the unfortunate dwellers in confined and crowded lanes and alleys, hardly ever traversed by the affluent, to shift for themselves as best they may—by padding and stuffing their windows and doors, for instance, or having recourse to any other contrivance which their ingenuity may suggest.

There is an old adage which tells you "to look before you leap." Had the authorities attended to this, as they were advised to do at the time, they would not have, to their own disgrace and to the great detriment of the public health, plunged into the present abominable system, at the sacrifice, moreover, let it be well understood, of an immense outlay of capital *positively squandered* in the creation of an additional nuisance, and a much more grievous one than that which it was intended to abate. How beneficially might not that capital have been applied towards the carrying out of a *judicious* system of drainage. After the lesson which the commissioners have *de facto* acknowledged to have received, we hope they will be wiser and less precipitate in future; and we trust that the several plans suggested to get rid of the nuisance, and to purify Father Thames, will be subjected to a most careful, minute, and, above all, *impartial* examination, which examination we should like to see conducted by *competent* persons, and such as are known to have *no leaning either way* in the matter. The commissioners should particularly guard against the hasty adoption of any plan involving the accumulation of vast masses of matter in localities where there exist no means of properly disposing of them.

A brief examination of the several plans that are now before the public may not be deemed out of place here, and may, perhaps, prove useful to those on whom the duty of investigating them will ultimately devolve. We have, in the first place, the plan proposed by Mr. Phillips, by which the drainage is to be conveyed into one immense sewer, to be sunk in the Thames from west to east of the metropolis, and subsequently to be pumped out again, at some point or points where it may be made available for agricultural purposes. The detailed report of this plan will be found in another part of our columns. The second plan is proposed by Mr. Austin: it contemplates the collection of the filth, &c., into sunks or large pits dug in different parts of the town, and from which pits it is equally to be pumped out at certain places, where the agriculturist is expected to *purchase* it for the irrigation of his land. The third plan is proposed by Mr. Coxworthy, who has submitted it to the Metropolitan Sewers Commission. At a sanitary reform meeting, held in October last, in the theatre of the City of Westminster Mechanics' Institution, Great Smith-street, J. Lettsom Elliott, Esq., in the chair, Mr. Coxworthy, in seconding one of the resolutions proposed, gave an outline of his plan, which we reprint here from the report of that gentleman's speech in the *Observer*:—

"Mr. Coxworthy seconded the resolution, and entered into an explanation of the evils arising from imperfect drainage. He observed that the gases generated in sewers might be divided into those which are heavier and those that are lighter than atmospheric air, the former preponderating in volume; but that, in consequence of their negative electrical condition, they all ascend to the upper part of the sewer and escape into the atmosphere and into buildings, producing the most injurious effect upon the health of the community at large. According to the new improved system adopted by the commissioners of sewers, under the direction of the Government, cesspools would altogether be got rid of, but by which the evil would be greatly increased, as the whole of the soil and other fecu-

lent matter must be carried through the sewers, by which the amount of the gases would be considerably augmented. As, however, a remedy for the evil, he proposed to provide for the sewers iron shafts or tubes by which to cause the lighter gases to pass off above the tops of the houses or highest inhabited buildings; and, in order to prevent the escape of the heavy gases, he suggested that electrical points should be adapted to these ventilators, which, by constantly drawing from the upper regions a stream of electricity, would effect their condensation in tubes, when they would return to the bottom of the sewers, and be absorbed by the water and soluble salts which it holds in solution. To prevent the pollution of the Thames, and to collect for agricultural purposes the valuable matter deposited in the sewers, he proposed to construct, in the discharging sewers, dams at about thirty feet apart, on which should travel trucks on rails, which, when filled, might be discharged into barges at the mouths of the sewers; and, in order to prevent the collection of vast quantities of water at any one point, he suggested that, in all probability, when the survey shall have been completed, it will be found that with great advantage the whole of the sewerage of the north part of London may be directed to the west towards Battersea-bridge, or higher up the river, and to the east to the river Lea, where ample space will be found for collecting the matter deposited by putrefaction. After some further remarks, Mr. Coxworthy concluded by seconding the resolution, and, the motion being put from the chair, it was carried unanimously."

Now, the two first plans may be regarded the same *in principle*, the object being to collect, either in sunks or in a large sewer, the whole drainage of this vast metropolis, with a view to its application to agricultural purposes. We have, therefore, to consider, first, the dimensions of the receptacles which it will be necessary to construct for the reception of this enormous amount of matter; secondly, the means which it will be necessary to provide for pumping out the contents; thirdly, the locality at which the filth is to be discharged, and the distance of that locality from the metropolis; and fourthly and lastly, the important question whether or not, when the filth has thus been conveyed into the country, the farmer will avail himself of it.

The first part of this question we refer to the surveyor, and, when he shall have reduced to figures the amount of water that is daily supplied by the several water companies, and the quantity of rain that falls on a surface eight or ten miles square, we feel convinced that he will have ample evidence to satisfy himself of the impracticability of the scheme—to say nothing of the expense which it must necessarily involve for fuel, machinery, and pipes to send the matter into the country, and for the construction of tanks to receive it there, and to render it available for the agriculturist.

It has been suggested, however, to separate the water-closets' soil from the other drainage of the town. This unquestionably is a practical measure, but its adoption must necessarily involve a by no means inconsiderable expense, for the construction of a separate drain to many houses, a separate set of sewers in the streets, a large drain, or tank, for the reception of the matter, and the requisite machinery to convey it to its final destination. But, presuming that the agriculturist could be prevailed on to accept of it *as a gift*, the outlay would probably be amply repaid to the inhabitants of the town by the consequent reduction in the price of provisions; but we have unfortunately but too strong testimony of there not being the most distant hope that any such desirable arrangement can *at present* be come to, it being a well-ascertained fact that at Windsor, Hounslow, Croydon, and other distant agricultural districts round London, the party removing *the soil of privies* is invariably paid, instead of paying, for the "stuff" he takes away. If, then, the *undiluted* soil be not deemed worth fetching by the farmer, on what ground can it be assumed that it will become more acceptable to him when mixed with at least twenty times its own weight of water?

We shall return to this important subject in our next.

ERRATUM.—Page 90, line 19 from the bottom, for "mirabile" *read* "mirabil."

PROCEEDINGS OF LEARNED SOCIETIES.

BOTANICAL SOCIETY OF LONDON.

Friday, July 6, 1849.—E. Doubleday, Esq., V.P., in the chair, which was afterwards taken by J. Miers, Esq., V.P., F.R.S. Mr. G. E. Dennis, the secretary, having announced various donations since the last meeting, Mr. Jasper W. Rogers read a paper "On the Uses and Properties of Peat Moss, and the Value of Peat Charcoal as a Disinfectant and Fertilizer." The object of the paper was to show the useful purposes into which the bogs of Ireland could be converted by the extraction of peat from them for its conversion into charcoal. The charcoal extracted from the Irish peat was far preferable to wood charcoal, and one of its greatest advantages was the effect it had as a disinfecting and deodorizing agent. Wood charcoal had not that property to nearly such an extent. It was, therefore, singular that now, when there was so much excitement about sanatory matters, an agent so powerful should have been so much overlooked. It was also valuable as being a powerful absorbent, as it would absorb about eighty per cent. of water, and keep it for the benefit of the soil which might surround it; while it took up the greater portion of the obnoxious gases inherent in night-soil and sewage matter, and thereby did away with any bad effect which might result from them. It, therefore, was capable of being converted into a manure of the greatest value, the proportions being two thirds of night-soil to one third of charcoal. It was impossible to find a better manure for the food of plants; for, containing as it did a large quantity of carbon, it exhaled the ammonia and the salt which were in the night-soil, did not allow them to escape, but treasured them up, and in due time gave them out for the sustenance of the plants placed under its influence. No better agent could be found for improving the sanatory condition of the metropolis. Were a proper system observed, by means of this agent the sewage matter of London could be converted into a source of great profit, while the bad effects arising from the effluvia which emanated from such matter would be got rid of. According to a calculation he had made, the matter so produced by a family of six would, in the course of a year, if subjected to the influence of this agent, yield £30 per annum; and, supposing the cost of the charcoal and other expenses to amount to £15, which they could not exceed, there would still be a clear profit of £15 yearly. That might be doubted, but it was a fact which he had ascertained after the most careful consideration; and he had further ascertained that, were all the houses in London which were rented at upwards of £10 to adopt that system, they would earn a profit of £15 per house, or three millions of money per annum. In order to do that they would have to collect the refuse from all these houses into one great cesspool, and then apply the agent he alluded to; and, were that done, it would be the best means of clearing the metropolis of that nuisance which now so much affected the health of its inhabitants; for, as matters now were, who could stand for an instant in the vicinity of one of those gratings in the street without being sensibly affected by the effluvia which proceeded from it? After some illustrations in proof of his statements, Mr. Rogers concluded his paper by stating that he was about to give the public a proof of the truth of his theory, by erecting an establishment for the purpose of carrying it out. He did not see the smallest difficulty there could be in carrying it out in the metropolis. At the present time their ashes were collected for the benefit of the parish in which they respectively resided; and why should they not give up the other refuse matter in like manner to the parish, upon a proper understanding? It was true no experiment had been as yet made on a large scale in order to test the truth of his theory, but the reason was, that charcoal could not be obtained on a large scale. He had been requested by the guardians of the poor at Macclesfied, some weeks ago, to try the experiment on a nuisance there; and, although the charcoal was of a very bad description, the peat having been obtained from a neighbouring moss, it had been eminently successful, and he had no doubt would be so in every case.

Mr. J. Toulmin Smith said, while he did not deny the efficiency of the agent spoken of by Mr. Rogers, he was a strong advocate for the use of liquid manure, as, after long practical experience, he had found it best suited for the purposes of vegetation. On his own premises he had a tank into which the whole of the excrement was conveyed from the house, and which he pumped out and applied for garden purposes in its liquid state, and he had always found it answer well.

Mr. Rogers conceived that Mr. Smith resided in the country.

Mr. T. Smith: At Highgate.

Mr. Rogers: Well, your system might do well at Highgate; but how is a man to carry it out in the heart of London? There was no doubt but liquid manure was valuable, but the moment it was pumped out of the tank, and came in contact with the air, that moment the ammonia passed from it and was lost; but, when mixed with charcoal, the moment the ammonia came in contact with the charcoal it was fixed, the charcoal acting as a reservoir for it, and giving it out to the plant when it was required.

Mr. T. Smith said into his tank a large quantity of water was run, and which he conceived was the best agent for mixing the refuse matter; and he thought it would also be the best agent for carrying away the refuse of London.

Mr. Rogers admitted water to be good enough in its way, but when a drop of it fell on one of those particles of charcoal it was retained, and given out as nourishment to vegetation in due time; whereas, if they poured water on the ground, and a bright sunshine were to follow it, it was all absorbed by the atmosphere, and vegetation got no benefit from it.

Mr. Edwin Chadwick said he came there rather to gain information than to make any remarks of his own. He admitted that there were cases where the agent referred to could be applied with propriety, as he had heard of sugar casks being returned to the West Indies filled with manure disinfected by such a process as that to which their attention was now drawn. He did not, however, think that, as regarded London, the system could be brought into practical application. The liquid manure he considered was quite sufficient for agricultural purposes. It was easy of transmission, and was now sent a considerable way into the country at a cheap rate, so that he saw no reason for a change; at the same time he did not discourage such investigations as the present, as the more facts they could get brought together on so important a subject the better.

Several other gentlemen spoke upon the subject, alluding to the great interest of the question, when Mr. Rogers sat down amidst much applause.

Thanks were voted to Mr. Rogers for his valuable communication, which was deemed worthy of the most serious consideration of the inhabitants of London.

MR. PHILLIPS'S PLAN OF DRAINAGE.

At a special court of the Metropolitan Sewers Commission, held on the 23d ult., for the purpose of receiving and considering the report of Mr. Phillips, the surveyor of the commission, for the drainage of the metropolis, the clerk of the court read a report on the subject, of which the following is a summary:—Having described the drainage area of the metropolis and the defects of the present system, including especially the pollution of the Thames and its tributaries, the report proceeds to lay down the principles of town drainage as a guide to and justification of the scheme set forth therein:—

"1. That two outfalls independent of each other should be provided—one for the discharge of natural or land and surface waters, and the other for the discharge of artificial or house and soil drainage.

"2. That in order to perfectly drain the subsoil of the town so as to free it from damp, and to carry off as quickly as possible the natural waters, a system of permeable land-drains and sewers should be provided to discharge into the natural watercourses and rivers.

"3. That, as outfalls are already provided by streams and rivers for the discharge of the natural waters, it is only necessary to provide separate and proper outfalls for the discharge of the artificial or house and soil drainage; which outfalls should convey the sewage, as fast as it is produced, to a depôt at a convenient and unobjectionable place, quite clear of and below the town.

"4. That in order to carry off the house and soil drainage without contaminating the atmosphere of the town by the escape of effluvia through the numerous inlets, as is at present the case, a system of impermeable drains should be provided distinct and separate from the permeable land-drains and sewers, to discharge without intermission into the said artificial outfall independently of the river.

"5. That at the main outlet a depôt should be formed and works established for raising the sewage, and for converting and distributing the same for agricultural and horticultural purposes."

The report then proceeds to explain the conformity of the proposed plan with the principles so set forth; and with reference to the tunnel or outfall sewer for house and soil drainage, having stated that Mr. Phillips proposes it should extend from the Plumstead Marshes to Twickenham, the following description of it is given:—

"From the depôt (where would be brought in the house drainage of Woolwich and Plumstead) the tunnel would pass under the river to East Ham and Plaistow Marshes, where might be received the house drainage of East Ham, Barking, Ilford, Plaistow, West Ham, Stratford, and the other towns in the neighbourhood, between the river Lea and the river Roding, in the county of Essex, and which drainage now runs either into cesspools or filthy open sewers and ditches, considerably polluting those rivers.

"From below Bow-creek the tunnel crosses the river to the Greenwich Marshes, where a shaft would be built and a branch drain laid across the marshes for the house drainage of Charlton, East Greenwich, Greenwich, and other places near, all of which are at present without any provision for efficient drainage.

"The tunnel then crosses the Thames near the east entrance of the West India Docks at Blackwall, where the present outfall of Poplar and Blackwall is situate. At this point a shaft would be formed and main branch drains laid to take in the house drainage of Poplar, Blackwall, and the Isle of Dogs, in addition to those parts of the Tower Hamlets and Bromley districts of sewers which now discharge into the river Lea.

"The line of tunnel continues between the export and import West India Docks to the margin of the river south of the eastern entrance of those docks, where a shaft and a main branch drain would be made to receive the house drainage of Limehouse, and to intercept the sewage discharging into the river between the City Canal and Shadwell Dock.

"Crossing the river to the Surrey side, the tunnel runs through the lower part of Rotherhithe. Here two shafts would be built with a main branch drain laid from the western shaft along Rotherhithe-street and the Lower Deptford-road, for the house drainage of the upper part of Rotherhithe, Deptford, and Hatcham. This branch might be extended up to Lewisham, Lea, Eltham, Sydenham, &c., following the course of, and as a substitute for, the river Ravensbourne and its minor branches. From the eastern shaft a branch drain would follow the bank of the Thames to the eastward, to intercept the sewage running into it along this part, as also for the house drainage of Lower Rotherhithe.

"The tunnel leaves Rotherhithe just below the entrance of the Grand Surrey Canal, and continues under the river to the Middlesex side, between the entrance to Shadwell Dock and the Rotherhithe tunnel, and runs south of the London Docks through the lower part of Wapping to the margin of the river above the entrance of Hermitage Dock.

"There would be two shafts along this part of the line. From the western shaft above Hermitage Dock a main branch drain would run round the north side of St. Katharine's Docks and the Tower, and along Thames-street to New Bridge-street, Blackfriars, intercepting in its course (and that within a very short distance of the river) all the sewage running into the Thames, as far as Temple-gardens, a distance of two miles. From the east shaft, near the bottom of New Gravel-lane, branches would be carried east and west for the drainage of Wapping.

"This part of the tunnel would receive the house drainage of the greater part of the Tower Hamlets district, and that of the whole of the city of London, including the Holborn and Finsbury districts, which drain through the Tower Hamlets and City sewers.

"Leaving the entrance of Hermitage Dock, the tunnel crosses the river to the Surrey side, near Shad Thames, and continues through the lower parts of Bermondsey, Southwark, and Lambeth, below Westminster-bridge.

"Four shafts would be constructed on this length:—The first near the river at Shad Thames; the second and principal one in High-street, Borough; the third in Blackfriars-road; and the fourth in York-road. Deep main branch drains, with any necessary amount of fall, would radiate from these shafts along the principal roads and streets to all parts of this extensive low flat district, and would be applicable for the thorough and complete improvement or rearrangement of the house drainage of Bermondsey, Southwark, Lambeth, Newington, Kennington, Walworth, Peckham, Camberwell, Dulwich, Norwood, Streatham, Stockwell, Clapham, Brixton, and Battersea, as well as of Wandsworth, Tooting, Mitcham, Carshalton, Merton, and other places near the banks of the river Wandle.

"From the Surrey side the tunnel would pass under the river below Westminster-bridge to the city of Westminster, and continue through that district to the King's Scholars'-pond sewer at Pimlico.

"In the enclosure between St. Margaret's Church and Parliament-street there would be a shaft over the tunnel, into which all the sewage running into the river between Temple-gardens and Westminster-bridge, a distance of one mile, might be conveyed by a main drain along the Strand, Charing-cross, Whitehall, and Parliament-street: the shaft at this spot would also serve for the outlet of the house drainage of the city of Westminster. Proceeding on through Pimlico, to Chelsea, and between Fulham and Hammersmith, the tunnel would intercept the large quantity of house and night-soil drainage at present collected by and flowing down the King's Scholars'-pond, the Ranelagh, the Counter's-creek, and other main sewers, which discharge into, and seriously pollute, the Thames between Vauxhall-bridge and Putney. There would be six shafts (exclusive of the one in Westminster) on this part of the line, from which deep main branch drains would be laid, affording the means of thoroughly draining the houses in Pimlico, Knightsbridge, Brompton, Chelsea, Kensington, Fulham, Walham-green, Hammersmith, the low grounds about Notting-hill, and other places contiguous.

"Crossing the river almost at right angles to Barnes, a short distance below Hammersmith-bridge, the tunnel would not only afford an outfall for that place, but also for the neighbouring town of Putney, and other places adjoining.

"The line is then carried under the river opposite Barnes, to receive the house sewage of Chiswick, Brentford, Ealing, Acton, Hanwell, and other places to the north.

"Crossing again, and taking up the drainage of Mortlake, with that of Kew, it would be continued upward for the drainage of Richmond, and that of Petersham and Kingston. It would then cross the river above Richmond-bridge, and take the house sewage of Twickenham and the neighbourhood.

"The direction of the tunnel may appear circuitous from the above description, but that impression will be immediately removed by a glance at the plan, which shows the line there marked, and explained above, to be a uniform curve which threads the windings of the river."

The tunnel so proposed would have a fall of 49 feet 3 inches throughout its length, which is 19½ miles, and would be 8 feet in diameter at its outlet, and 6 feet at the upper end. It is proposed that it should cross under the river eleven times, that shafts should be sunk in convenient positions along it, that there should be a depôt at Plumstead Marshes for raising the sewage to be applied as manure, and the following estimate of the scheme is supplied:—

Constructing 19½ miles of tunnel sewer, at an average of £23,709 per mile, including shafts.....	£512,323
Constructing the shaft at the terminus.....	4,099
Steam-engines, pumps, and boilers, complete.....	95,000
Engine-house, &c.	33,577
Total estimated cost of 19½ miles of tunnel sewer, with machinery, &c..	£644,999

The annual cost of maintenance, consumption of coals, and superintendence, is set down at about £15,000, and it is calculated that the rated value of the property draining into this tunnel sewer being £10,000,000, an annual rate of 1d. in the pound for twenty-two years would suffice to pay the principal and interest.

In answer to a variety of questions put by the Lord Mayor, Professor Airey, Viscount Ebrington, Mr. Walter, Mr. Chadwick, and Mr. Leslie,

Mr. Phillips explained that the depôt would be 10 feet deep, and would be elevated above the surface 20 feet; that an average of 10,000,000 cubic fect of sewage would be discharged into it during the day, but this would be precipitated and filtered, until the liquid parts were reduced as nearly as possible to pure water, while the solid matter remained. When there was no demand for liquid manure, it might be directed into the Thames, or the sea, or otherwise disposed of as the circumstances might render advisable. The whole works could be completed, he thought, in two years.

THE PUBLIC HEALTH.

[From the Registrar-General's Return.]

Again the return indicates an increase on the excessive mortality of the previous week. The

deaths from all causes, which in three previous weeks were respectively 1,070, 1,369, and 1,741, rose to 1,931, a number which is almost double the weekly average, and exceeds that of the former week by nearly 200. To compare these results with the deaths from all causes in four weeks, when influenza was unusually fatal, in the last quarter of 1847, it may be stated that the mortality at that time increased in the following numbers:—1,086, 1,677, 2,454, 2,416, and in the fifth week continued to decline. The deaths from cholera, which in three previous weeks were 152, 339, 678, rose in the last to 783, a rate of increase which it will be observed is not so great as in the first weeks of the outbreak. But the deaths from diarrhœa (fatal in a great majority of cases to children) and dysentery, which in three previous weeks were 54, 100, and 146, increased in the last to 238, showing a more rapid increase recently than the mortality from the more malignant form of the disease. In the corresponding week of 1848 the deaths from diarrhœa and dysentery amounted to 187, a mortality which is almost as considerable as the return of last week. The total deaths from the three diseases in the present return were, therefore, 1,021, whilst the weekly average of the season is only 92, a result, when compared with the excess of mortality from all causes, which shows that the aggregate deaths from other diseases do not vary much from the usual amount. Smallpox, scarlatina, and typhus, however, are now under the average, especially the first two of these zymotics; measles and whooping-cough have fallen to the average. Cholera was fatal last week to 382 males and 401 females; previous returns showed a majority on the other side. The districts on the south side of the river still form the field on which the disease is most active. The deaths from it, which in this region were in three previous weeks, 93, 192, 443, rose last week to 514. There is a slight decrease in the eastern districts. In the western and northern, comprising Kensington, Chelsea, St. George (Hanover-square), Westminster, St. Martin-in-the-Fields, St. James, Marylebone, Pancras, Islington, Hackney, and Hampstead, the deaths were only 68 against 53 in the preceding week. The districts which show the greatest mortality are Bermondsey, where 64 deaths occurred last week, Newington, where there were 66, St. George (Southwark), where there were 70, and Lambeth, where there were 111.

The mean height of the barometer in the week was 29.598. The temperature was generally below the average during the week. The mean was 58 deg. 9 sec.

THE ARTESIAN WELL AT GRENELLE, PARIS.

This well, which required upwards of seven years to complete, is about 1,800 feet deep, and yields water enough to supply each inhabitant of Paris with nearly one gallon of water per diem. After penetrating to a depth of more than 1,500 feet, the sounding instrument arrived at length at the green sand under the chalk formation, which a knowledge of the Paris basin enabled M. Arago to predict with certainty must be attained if the boring were persevered in. The instant outpouring of the water, and its rising in a jet above the surface of the ground, were also anticipated, as the result of penetrating the chalk; but the quantity of water obtained was greater than was expected. The jet of water rises thirty feet above the surface of the ground, and this phenomenon has given rise to much ingenious speculation for obtaining an ever-ready motive power, by boring for water, and employing the ascending force to propel machinery.

The notion seems to prevail that by boring to great depths in any situation a jet of water may be obtained; it may be advisable, therefore, to explain the cause of the flow of water in artesian wells, for the purpose of correcting the prevalent error. The rise of the water in wells of this kind depends entirely on the known principle in hydrostatics, that fluids tend to their level, though the rising of the water above the surface of the earth may appear to contradict this law. A short statement of the circumstances will, however, show that the action of the artesian well at Grenelle depends entirely on the principle that fluids find their level. The city of Paris lies in a valley. The strata on which it rests forms a kind of basin, inclining upwards to the higher surrounding ground, and dipping down into the valley. These strata consist of layers of alluvial soil, and various kinds of limestone and sand, abounding in fossil remains, to a depth of about 400 feet; a bed of plastic clay, resembling the lower division of the London clay, is then arrived at. This clay covers the chalk which may be considered the foundation-rock on which Paris rests. Under the chalk lies the stratum of green sand which it was the object of the enterprising borers to reach, and under the sand is another bed of clay. The stratum of green sand and the chalk above it take the same direction as the upper strata, and rise, at a considerable distance from Paris, to a level much higher than that city. The rain percolates readily through the sand, but is stopped by the clay underneath and above it; therefore, as the sand is in a basin-like form, it may be considered as a great reservoir, in which is collected the rain that falls on the extended area which it presents at the surface. It must be apparent, therefore, that, if a tube be forced down through the superincumbent strata, the water in this hollow reservoir will tend to rise to the level of the water which is pressed down with the force of gravitation in the higher parts of the concavity. As the water in those portions stands considerably higher than the level of Paris it is thus forced above the surface of the ground, on the same principle as a fountain is made to play by connecting the jet-pipe with an elevated reservoir of water. A great portion of the ascending force is, indeed, lost by friction, otherwise the jet d'eau would be much higher. If, on the other hand, the aperture were as large as that of a common well, the supply would not be sufficiently rapid to form a jet with so large a column of water, and the well would only run over. This is no uncommon case when wells have been sunk to great depths in situations favourable to the ascending fluid. At Derby, for instance, a well of this kind was sunk, and, in order to make the ascending power of the water available, strong waterproof walls were built round the well, so as to raise the level of the water within it above the tops of the houses to be supplied.

It appears, from the foregoing consideration of the action of artesian wells, that they can only be successfully made when the position and nature of the strata are favourable; and that it is requisite the spot should be below the upper level of the subterranean reservoir. It is necessary, also, that the water in that reservoir should be confined above and below by strata almost impervious to water; otherwise there could be no continuous supply, for the water would either percolate through the strata beneath, or it would be forced into, or absorbed by, the earth above. There is no ascending power obtained in artesian wells by the smallness of the bore. The only difference in this respect between common wells is, that the supply is not sufficient to force the larger mass of water into a jet. It may be assumed, therefore, that, in all cases where the water in artesian wells rises in a jet, a common well, if sunk on the same spot, of an equal depth, would overflow.

The well water of Paris is almost saturated with sulphate of lime (called also by the names of gypsum and plaster of Paris), insomuch so that this water is totally unfit for domestic purposes. The water of the artesian well is remarkably soft; giving, in analysis, only 0.105 grains of saline matter to the gallon, the greater part of which is carbonate of lime and bicarbonate of potass. This is in the proportion of about 1 in 7,000. The analysis of 100,000 parts of this water gave of—

Carbonate of lime	6.8
Carbonate of magnesia	1.42
Bicarbonate of potass	2.96
Sulphate of potass	1.2
Chloride of potassium	1.09
Silica	0.57
Organic matter	0.26
	14.30

The quantity of saline matter in the filtered Thames water is about twelve grains to the gallon, or nearly 1 in 5,000; the principal saline contents being carbonate of lime and sulphate of lime. The artesian water of Grenelle, like the artesian water of Trafalgar-square, possesses an alkaline reaction, which is due in the former case to bicarbonate of potash, and in the latter to bicarbonate of soda. This last-mentioned alkaline salt exists in all the deep artesian wells of London to some extent. It is difficult to say whence it is derived, unless we suppose that it is produced by the reaction of the common salt contained in the sea air on the chalk strata which forms the outskirts of the London basin. Efflorescences of carbonate of soda, from this cause, have been found on the chalk downs for many miles inland; and the superficial washings of these strata may become thus impregnated with the carbonate of soda; and the water may afterwards infiltrate into the London basin, between the beds of sand and chalk.

The artesian well at Grenelle is the deepest known source in the world from whence water is obtained; the temperature of the water is 82° Fah., or 31° above the mean temperature of water. In the winter the water feels sensibly warm; and the Parisians regret that the operations have not been carried on sufficiently deep to obtain a good supply of water for their hot-baths.

The following are the results of the analysis of the water from the deep well in the brewery of Messrs. Combe and Delafield, Long-acre. An imperial gallon of the water contained 56.45 grains of solid matter, 100 parts of which gave:—

Carbonate of soda	20.70
Sulphate of soda	42.94
Chloride of sodium	22.58
Carbonate of lime	10.96
Phosphate of lime	0.34
Phosphate of iron	0.43
Silica	0.79
Carbonate of magnesia	1.92
	100.66

MISCELLANEA.

PATENTS RECENTLY GRANTED.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF SCOTLAND, FROM THE 22D DAY OF JUNE, TO THE 21ST DAY OF JULY, 1849, INCLUSIVE.

Walter Neilson, of Hyde-park-street, in the city of Glasgow, North Britain, engineer, for an improvement or improvements in the application of steam for raising, lowering, moving, or transporting heavy bodies. Sealed June 25th, 1849; six months.

David Smith, of the city of New York, in the United States of America, lead-manufacturer, and a citizen of the said United States, for certain new and useful improvements in the means of manufacturing certain articles in lead. Sealed June 25th, 1849; six months.

Edmund Grundy, of Bury, in the county of Lancaster, woollen-manufacturer, and Jacob Farrow, of the same place, manager, for certain improvements in machinery or apparatus for preparing wool for spinning, and also improvements in machinery or apparatus for spinning wool and other fibrous substances, Sealed June 25th, 1849; six months.

Robert William Laurie, of Carlton-place, in the city of Glasgow, North Britain, merchant, for improvements in means or apparatus to be employed for the preservation of life and pro-

perty, such improvements, or part thereof, being applicable to various articles of furniture, dress, and travelling apparatus. Sealed June 25th, 1849; six months.

Edward Hawkins Payne, of Great Queen-street, in the county of Middlesex, coach-lace manufacturer, and Henry William Currie, engineer, for improvements in the manufacture of coach-lace, and other similar looped or cut pile fabrics. Sealed July 9th, 1849; six months.

Robert Urwin, of Ashford, in the county of Kent, engineer, for certain improvements in steam-engines, which may in whole or in part be applicable to pumps, and other machines not worked by steam power. Sealed July 9th, 1849; six months.

William Wilson, jun., residing at Campbell-field, Glasgow, in the county of Lanark, Scotland, for improvements in cutting plastic tubes or tiles. Sealed July 10th, 1849; four months.

James Godfrey Wilson, of Millman-row, Chelsea, in the county of Middlesex, engineer, for certain improvements in obtaining perfect combustion, and in apparatus relating thereto, the same being applicable generally to furnaces and fireplaces, as also to other purposes where inflammable matter or material is made use of. Sealed July 11th, 1849; four months.

William Crofton Moat, of Upper Berkeley-street, in the county of Middlesex, surgeon, for improvements in engines to be worked by steam, air, or gas. Sealed July 16th, 1849; six months.

William Kenworthy, of Blackburn, in the county of Lancaster, cotton-spinner, for certain improvements in power looms. Sealed July 16th, 1849; four months.

George Benjamin Thorneycroft, of Wolverhampton, in the county of Stafford, ironmaster, for improvements in manufacturing railway tyres, axles, and other iron, where great strength and durability are required. Sealed July 16th, 1849; six months.

Edward Ives Fuller, of Margaret-street, Cavendish-square, in the county of Middlesex, carriage-builder, and George Tabernacle, of Mount-row, Westminster-road, in the county of Surrey, coach-ironfounder, for certain improvements in metallic springs for carriages. Sealed July 17th, 1849; six months.

Peter Augustine Godefroy, of Wilson-street, Finsbury-square, chemical colour-manufacturer for certain improvements in dressing and finishing woven fabrics. Sealed July 18th, 1849; four months.

John Grantham, of Liverpool, engineer, for improvements in sheathing ships and vessels. Sealed July 18th, 1849; six months.

Joseph Eccles, of Moorgate Fold Mill, near Blackburn, in the county of Lancaster, cotton spinner and manufacturer, and James Bradshaw and William Bradshaw, of Blackburn, in the same county, watchmakers, for certain improvements in, and applicable to, looms for weaving various descriptions of plain and ornamental textile fabrics. Sealed July 19th, 1849; four months.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF IRELAND, FROM THE 20TH DAY OF JUNE, TO THE 21ST DAY OF JULY, 1849, INCLUSIVE.

James Hamilton, of London, civil engineer, for improvements in cutting wood. Sealed June 28th, 1849; six months.

Michael Loam, of Treskerly, in the parish of Gwennagh, in the county of Cornwall, engineer, for improvements in the manufacture of fuzees. Sealed June 30th, 1849; six months.

David Smith, of the city of New York, in the United States of America, lead-manufacturer, for certain new and useful improvements in the means of manufacturing certain articles in lead. Sealed July 7th, 1849; six months.

William Newton, of Chancery-lane, civil engineer, for improvements in the jacquard machine. Sealed July 11th, 1849; six months.

PATENTS RECENTLY EXPIRED.

J. C. Dyer, of Manchester, machine-maker, and J. Smith, spinner, for certain improvements in machinery used for winding upon spools, bobbins, or barrels, slivers, or rovings of cotton, wool, and other fibrous substances of the like nature. Patent dated July 17th, 1835; expired July 17th, 1849.

W. Vickers, of Sheffield, merchant, for improvements in machinery for preparing or shaping steel for the manufacture of files and rasps. Patent dated July 17th, 1835; expired July 17th, 1849.

J. H. J. Poitterin, of Middlesex, gentleman, for a powder which is applicable to the purposes of disinfecting night soil and certain other matters, and facilitating the production of manure. Patent dated July 17th, 1835; expired July 17th, 1849.—(Communication.)

J. Dickinson, of Middlesex, Esquire, and W. L. Tyers, of Hertford, for certain improvements in the manufacture of paper. Patent dated July 24th, 1835; expired July 24th, 1849.

T. Horne, of Birmingham, brassfounder, for certain improvements in the manufacture of hinges. Patent dated July 24th, 1835; expired July 24th, 1849.

H. B. Chaussenot, of Middlesex, engineer, for an improved construction of the lamps or apparatus used for burning gas, for producing a better combustion of the gas. Patent dated July 28th, 1835; expired July 28th, 1849.

S. R. Anderson, of Cornhill, Esquire, for improvements in hand and power looms. Patent dated July 28th, 1835; expired July 28th, 1849.

R. and A. Charlton, of Manchester, calenderers, for certain improvements in the machinery used for stiffening and finishing woven or manufactured goods. Patent dated July 28th, 1835; expired July 28th, 1849.

STORM GLASS.—This name is applied to a glass tube about twelve inches long, and three fourths of an inch in diameter, nearly filled with one of the following solutions:—No. 1. Camphor two drachms, nitrate of potash one and a half drachm, salammoniac two drachms, proof spirit two ounces. Mix.—No. 2. Camphor two and a half drachms, nitrate of potash 38 grains, salammoniac 38 grains, rectified spirit 11 drachms, water 11 drachms. Mix. The following indications are said to be afforded by the storm glass:—1. If the solution be very clear, with only a small quantity of crystalline matter at the bottom of the glass, fine dry weather may be expected. 2. The formation of fresh crystals, extending upwards through the glass, while the liquid still continues clear, indicates a change of weather with rain. 3. The formation of plumose crystals, some of which float in the upper part of the liquid, while the liquid itself assumes a turbid appearance, indicates the approach of a storm with high wind.

ROYAL COLLEGE OF SURGEONS.—The following gentlemen, having undergone the necessary examinations for the diploma, were admitted members of the college at the meeting of the Court of Examiners on the 27th ult.:—Messrs. Edward Leopard Neville, Hounslow, Middlesex; Owen William George, Plascrwn, Pembrokeshire; William Percy Pickard Mackesy, Waterford; Edward Philip Leigh, Jamaica; Edward Jonn Vivian, Guildford-street, Russell-square; Arthur Rudge, Pakenham, Norfolk; William Aston Lewis, Manchester; Robert Adamson, Durham; John Harrison Robotham, Wilne, Derbyshire; Joseph Sawyer, Whitehaven, Cumberland; and John Earnshaw, Clithero, Lancashire.

APOTHECARIES'-HALL.—The following are the names of gentlemen who passed their examination in the science and practice of medicine, and received certificates to practise, on Thursday, the 26th of July, 1849:—Edward Jackson, Sheffield; Thomas Allen, London; Arthur Octavius Arden, Beverley, Yorkshire; Richard Eaton Rusher, Oxford; William Talbott King, Hackney; Joseph Barton Carter, Beverley, Yorkshire; Charles James Evans, Belper; George Cochrane Millar; John Markwell Todd, New-cross-road, Deptford; Thomas English; John Harrison Robotham, Wilne, Derbyshire.

IMPORTATION OF FOREIGN GLASS.—A return, moved for by Mr. Richard Spooner, M.P., shows that the total imports of foreign glass in the year 1848 were as follow, viz.:—31,037 cwt. of white or stoned window glass, of one colour only; 90,442 square feet of silver and polished glass; 1,195 feet of painted or otherwise ornamented glass; 38,086 lb. of white flint-glass bottles, not cut or engraved; 154,343 lb. of wine glasses, tumblers, and all other white flint-glass goods, not cut or otherwise ornamented; 639,967 lb. of all flint cut glass, flint coloured glass, and fancy ornamental glass; and 370 cwt. of glass manufactures not otherwise described. The quantities of British glass exported from this country in the year 1848 were as follow, viz.:—15,296 cwt. of flint-glass, 19,708 cwt. of window glass, 49,227 feet of plate glass, 194,755 cwt. of common glass bottles, and £6,965 worth of looking-glasses and mirrors.

TOOTH CEMENT.—Put two ounces mastic, and three ounces absolute alcohol into a bottle capable of holding two pounds. Effect solution by the aid of heat. Add nine ounces of dried balsam of tolu, and again apply the heat (hot water), and frequently shake the ingredients together; then allow the bottle to stand in the hot water for some time. This is to be introduced into the tooth with a piece of cotton wool.

TO CORRESPONDENTS.

"Mr. W. Robertson, Banff."—Try essence of lavender, oil of cajeput, or a mixture in equal proportions of essence of turpentine and oil of tobacco.

"Inquirer, Dublin."—The following is the best process of preparing congreves:—Take of gum arabic and vermilion, of each 16 parts; phosphorus, 9 parts; saltpetre, 14 parts. Reduce the phosphorus to a state of minute division, by agitating it with fresh urine, or, still better, with a solution of pure urea (which latter substance may now be readily procured by Liebig's process). The vessel in which the phosphorus is mixed with the urine or solution of urea must be put into hot water (with great caution) until the phosphorus is melted. Mix the phosphorus now with the other articles made into a paste with the gum dissolved in the least quantity of water. Dip the matches into the mixture, and dry them. Dip the dry matches into a dilute varnish of copal, or into a thin solution of gum arabic containing saltpetre, and dry them again. These matches require no previous coating with sulphur, provided the body of the matches, whether of wood or pasteboard, be properly prepared.

"A Mechanic, Sheffield."—The term aqua vitæ means simply eau de vie or water of life—*anglicé* brandy.

"The Secretary of the Vegetarian Society."—We cannot lend our columns for the propagation of absurdities, of however so amiable and harmless a nature they may happen to be. We would suggest to the secretary and to the members, more particularly to the worthy president, Mr. Brotherton, the propriety of an ocaasional mutton chop or rumpsteak during these trying times when the cholera is prowling about seeking whom it may devour: it would be a pity and a grievous loss, indeed, for the House of Commons to be parted from its midnight clock.

"R. T."—Use the strongest hydrochloric acid.

"Tyro."—We cannot decipher your letter.

"Chemicus."—Try a mixture (in equal proportions) of fuming nitric acid and fuming sulphuric acid.

THE CHEMICAL TIMES is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentleman may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary or scientific communications to be addressed to the Editor, 320, Strand.

ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXVIII.

(LECTURE CI.)

VEGETO-ALKALIS—(*Continued*).

PHARMACEUTICAL PREPARATIONS OF OPIUM—(*Continued*).

SECTION V.—PRODUCTS OBTAINED BY THE ACTION OF ACETIC ACID UPON OPIUM.

Acetic acid and vinegar dissolve all those principles of opium which are equally soluble in water; they dissolve a larger proportion of narcotina and resinous matter than the latter menstruum.

ACETIC EXTRACT OF OPIUM.

(LALOUETTE'S EXTRACT OF OPIUM.)

Take of Purified opium, 1 part.
Distilled vinegar, 32 parts.

Let the opium macerate in the vinegar; filter, and evaporate the filtrate to the consistence of an extract.

Vinegar is a better solvent for the narcotina and the resinous matters than water. Lalouette's extract is accordingly richer in resin than the aqueous extract; it ought to contain the whole of the narcotina of the opium. Its composition has not been sufficiently studied as yet, however, to pronounce with certainty on the absolute and relative proportions of the principles contained in it.

Some physicians attribute peculiar properties to Lalouette's extract.

LALOUETTE'S LIQUID OPIUM.

Take of Lalouette's extract of opium, 4 centigrammes.
Spanish wine, 1 gramme.

Dissolve.

CHRESTIEN'S ACETIC EXTRACT.

Take of Purified opium, 1 part.
Distilled vinegar, 16 parts.

Let the opium macerate in the vinegar; filter, and evaporate the filtrate to the consistence of an extract.

CHRESTIEN'S LIQUID OPIUM.

Take of Chrestien's extract of opium, 1 part.
Alcohol, 2 parts.
Water, 16 parts.

Mix, and dissolve.

OPIUM VINEGAR.

Take of Crude opium, 1 part.
Very strong white vinegar, 8 parts.

Cut the opium in slices, and let the latter macerate in the vinegar for twenty-four hours. Macerate, and continue the maceration subsequently for five or six days. Strain with expression, and filter.

The vinegar dissolves the salts of morphia and codeïa, the narcotina, the oily and resinous principles, and the colouring matters.

ACETIC TINCTURE OF OPIUM.

(OPIUM VINEGAR OF THE FRENCH CODEX.)

Take of Crude opium, 1 part.
Very strong vinegar, 6 parts.
Alcohol at 80 Cent., 4 parts.

Divide the opium in the vinegar, add the alcohol, and let the mixture macerate for eight or ten days; strain with expression, and filter through paper.

This formula is that of the United States of America. It is used as a substitute for another preparation, the so-called *black drops*, a species of secret medicine of which several different formulæ have been published. Most of these formulæ agree in prescribing vinegar as the solvent. The original formula, however, prescribes verjuice or the juice of crab apples.

BLACK DROPS (QUAKERS' DROPS).

Take of Crude opium, 12 parts.
Vinegar, 96 parts.
Pounded nutmegs, 3 parts.
Incised saffron, 1 part.
Sugar, 8 parts.
Beer yeast, 2 parts.

Mix, and let the mixture stand for one month. Expose it now to the air, until the liquid has acquired a syrupy consistence; strain, filter, and bottle; add to each bottle a little sugar.

The directions to expose the liquid to the air until it has acquired a syrupy consistence, and to add a little sugar to each bottleful, are vague in the extreme, and with so energetic an agent as opium may lead to lamentable results. In my opinion, the safer course would be to expel this preparation from the Pharmacopœia, and to substitute in its stead the acetic tincture of opium, as recommended by Dr. George Wood and Dr. Franklin Bache.

Some medical authorities maintain that the black drops do not possess the stimulating properties of opium, and that they excite neither nausea, nor giddiness, nor headache.

Other vegetable acids seem to modify the narcotic action of opium in the same way as vinegar. Dr. Porter, of Bristol, proposes to substitute for the black drops the following preparation:—

DR. PORTER'S LIQUOR.

(LIQUOR OF CITRATE OF MORPHIA.)

Take of Opium, 2 parts.
Citric acid, 1 part.
Distilled water, 16 parts.

Bruise the opium together with the citric acid in a porcelain mortar; add the distilled water boiling; let the mixture stand for twenty-four hours; strain with expression, and filter.

The degree of concentration of this preparation is about the same as that of the black drops.

The following table shows the relative medicinal values of the different preparations of opium. In consulting this table it must be borne in mind, however, that opium is rather a complex compound, and that the elements which are respectively associated in these divers preparations with the same quantity of morphia may singularly modify their respective medicinal action:—

One part of crude opium is equivalent to	
Morphia	0.07
Aqueous extract	0.5
Extract freed from narcotina	0.45
Vinous extract	0.6
Acetic extract	0.6
Tincture of crude opium	12
Tincture of extract of opium	6
Simple wine of opium	10
Sydenham's laudanum	8.5
Rousseau's drops	3.6
Opium vinegar	8.5
Acetic tincture of opium	10
One part of extract of opium is equivalent to	
Morphia	0.15
Crude opium	2
Aqueous extract	1
Extract freed from narcotina	0.9
Vinous extract	1.2
Acetic extract	1.2
Tincture of crude opium	24
Tincture of extract of opium	12
Simple wine of opium	20
Sydenham's laudanum	17
Rousseau's drops	7
Opium vinegar	17
Acetic tincture of opium	20

POPPY.

The head of the poppy seems to contain the same principles as opium, though in smaller proportions.

To obtain the poppy in the fulness of its medicinal vigour the heads ought to be gathered before the seeds have arrived at maturity. The poppy heads of commerce, however, are gathered when the seeds are ripe, and, as the seeds ripen at the expense of the juice of the pericarpium, it will be readily understood that there is a vast difference between the green and the dry heads, the action of the former being, of course, much more energetic than that of the latter. Lamentable accidents have frequently been caused by the incautious substitution of green for dry poppy heads in the preparation of certain infusions or decoctions of poppy intended to serve as sedative potions, &c.

The proper way of preparing the sedative infusion of poppy is to infuse thirty grammes of dry poppy heads in a quart of boiling water. This infusion will serve equally for lotions and sedative fomentations. For the preparation of sedative clysters of poppy the dose is reduced to fifteen or twenty grammes in a quart of boiling water.

EXTRACT OF POPPY.

Remove the seeds, and slice the pericarpium. Treat the slices with alcohol at 56 Cent.

It results from experiments made by M. Dublanc that one part of morphia is contained in

95 parts of alcoholic extract of poppy;

333 parts of extract prepared with the expressed juice of poppy;

1,700 parts of extract prepared from the infusion of the dry heads.

The treatment of poppy heads with alcohol at 56 Cent. yields about 17 parts of extract of almost pilular consistence. One part of alcoholic extract is, accordingly, equivalent to 6 parts of poppy heads (freed from the seeds, of course).

DIACODIUM.

Take of Alcoholic extract of poppy, 1 part.
Distilled water, 8 parts.
Simple syrup, 100 parts.

Dissolve the extract in water, filter the solution, and mix it with the boiling syrup. Keep the mixture boiling until the syrup is reduced again to the proper degree of concentration. Strain.

30 grammes of diacodium contain 30 centigrammes of extract of poppy.

ROYAL COLLEGE OF SURGEONS.—The following gentlemen having undergone the necessary examinations for the diploma were admitted members of the college at the meeting of the court of examiners on the 3d inst.:—Messrs. Thomas Hardy, London; Edmund Manley, Manchester; Charles George Woodd, Bromley, Kent; Edward Morgan Puddicombe, Dartmouth, Devon; Algernon Sudlow, Twickenham, Middlesex; Benjamin Davies, Froodvale, Carmarthenshire; John Candler, Halesworth, Suffolk; Thomas Hutchinson, Camborne, Cornwall; Richard Pope Jeston, Henley-on-Thames; James Gilbert Martyn, Camelford, Cornwall; James Rigby, Stockport, Cheshire; and John Clarke, Newbury, Berkshire. At the same meeting of the court Mr. George Edward Nicholas passed his examination for naval surgeon. This gentleman had previously been admitted a member of the college, his diploma bearing date February 6, 1846.

THE NEW ACT RELATING TO NUISANCES REMOVAL AND DISEASES PREVENTION.—The new act to amend the Nuisances Removal and Diseases Prevention Act of last year came into force on Wednesday last. Power is given to summon witnesses, and to enable the secretary of the Board of Health to institute and carry on prosecutions for violation or neglect of regulations ordered. In certain cases guardians of the poor may direct proceedings and prosecutions, and defray expenses attending the same. There are four clauses in the act relating to burial-grounds. The General Board of Health may cause inquiry to be made into the state of burial-grounds, and are authorized to direct measures of precaution. In the case of a churchyard being dangerous to health, the churchwardens may agree for the burial of parishioners in the ground of any other parish. The General Board of Health may order inquiries, while it may be expedient to prohibit interments, and, upon report, the Board of Health may frame a scheme for providing a new burial-ground. The act is to be deemed one with the other act.

STATEMENT IN CONTINUATION OF THE ONE PUBLISHED IN THE CHEMICAL TIMES OF AUGUST 4, 1849, SHOWING THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE AIR FROM JULY 29 TO AUGUST 4 INCLUSIVE, AS INDICATED BY THE EVAPORATION OF WATER FROM TWO COPPER VESSELS OR SCALES, ONE INSULATED AND THE OTHER NOT. ALSO THE READING OF THE BAROMETER, THERMOMETER, DIRECTION OF WIND, AND GENERAL STATE OF THE WEATHER.

July & Aug. 1849.	Barometer.		Therm.		Scales.				Wind.		General state of weather.
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Insulated	Non-Insulated	Morning.	Evening.	
29	29.83	29.80	64	59	..	..	..	..	SW.	SW.	Cloudy morning, heavy showers at noon, and slight showers and sunshine rest of day.
30	29.68	29.68	61	61	5 I.	5 I.	10	..	W.	SW.	Fine all day; a shower at six o'clock evening.
31	29.78	29.95	62	62	5 I.	40 I.	45	..	NW.	NW.	Fine all day, but cloudy; black ones under the white.
1	30.05	30.15	62	64	5 I.	30 I.	35	..	NW.	NW.	Fine all day, and a fresh breeze.
2	30.05	30.03	63	66	5 N.	5 I.	5	5	NW.	NW.	Fine all day, but threatened for rain at eight o'clock.
3	29.98	30.00	60	58	..	10 N.	..	10	NE.	NE.	Generally dull and overcast all day.
4	29.98	29.92	58	58	10 N.	..	..	10	NE.	NE.	Fine all day, but chilly.

The above shows a balance of seventy grains differenee of evaporation in favour of the electrical eondition of the air; if, therefore, the epidemic eontinues it must be referable to some other cause than want of electricity.

Westminster-road, Aug. 6, 1849.

Franklin Coxworthy, Author of "Electrical Condition," &c.

FRANKLIN COXWORTHY'S DISCOVERIES IN NATURAL PHILOSOPHY.

[From the *Cheltenham Journal.*]

There must be a beginning to all things, whether the period of their existence be of the shortest or of the most extended term. To deviate from an accustomed set of opinions, and propose others in lieu of them, is frequently equivalent to beginning anew, with what has been deemed an established system. And, strange as it may appear, it is nevertheless unquestionably true that there is more difficulty in correcting pre-existing errors in the physical sciences, in which demonstrable experiments and concurrent facts are only received in evidence, than in winning over to a new hypothesis in anything purely speculative those who have adhered to an older opinion of a nature diametrically opposed.

Hence it is that, having laboured to the same end year after year under the most discouraging circumstances, Franklin Coxworthy is only now beginning to obtain the attention of the scientific communities to discoveries which will go very far to subvert the pre-existing theories respecting electricity. And these form only a part of his negations of the previously affirmative dicta of men highly honoured in the archives of science.

Satisfied by patient examination of the correctness of many of his conclusions, and unable positively to controvert any of them, we shall avail ourselves of the advantage we possess of frequent personal communications with him, and present to our readers, in possibly a more perfect form than they may be elsewhere produced, the salient points of Franklin Coxworthy's discoveries, with their more immediate application to practical purposes.

It is not at all improbable that, having thus far perused this introductory paper, our readers may ejaculate, "Who is Franklin Coxworthy?" And, as we wish to be placed as soon as we can on an intimate footing with those we have the pleasure to address, we will endeavour to propitiate their friendly feelings by at once gratifying their presumed and not unreasonable curiosity, although we shall thereby occupy the entire space allocated to us for our own lucubrations this week, and have, consequently, to defer until the next what is certainly more prominent in our own thoughts.

Franklin Coxworthy is an energetic man, somewhat under the medium stature, with regular features approximating to the Grecian contour, an active frame, and a healthy temperament. Full of his mission, he dilates rapidly on any objeet connected with it, and enjoys the mistakes of an opponent, or the recollection of having anticipated what another may announce as a novelty, with as much glee as a schoolboy does the successful ascent of a kite or the unexpected finding of a bird's nest. He cannot have attained his forty-fifth year, yet the bushy eyebrow "where thought reclines" might lead us to suppose him older. A native of Devonport, he received a cursory education chiefly in France, at the seminaries of Nantes and St. Malo. Soon after leaving school, and without any further definite direction of his studies, he received the appointment of a clerk in the Ordnance Department, in which official employment he has continued upwards of twenty years. Almost simultaneously with his entering upon its duties he commenced the study of chemistry, *en amateur*, in the chemical class of the London Mechanics' Institute, Southampton-buildings. This ultimately led to the development of his discoveries, then in an incipient state, and chiefly with reference to the formation of snow, and modes of ventilation, in "The Mechanics' Magazine" of 1844. He had, however, about twelve years previously written on "Spontaneous Combustion" in "The London Journal of Arts." The subject of the electrical condition of the earth and atmospherc began to occupy his attention immediatcly after the publication of his papers "On the Formation of Snow, &c.;" and the results, comprising, in our humble opinion, discoveries of an extraordinary and most important nature, were partially communicated to "The Chemist" in 1847, and are now in course of completion in the *Chemical Times*, which succeeded the other publication. Such, then, is a brief pen-and-ink outline of Franklin Coxworthy and his labours in natural philosophy.

Having thus introduced the discoverer to our readers, we have now to notice the two first steps taken by him in subversion of previously existing opinions. And, not more as matter of reference than at once to elucidate the difference, we place the respeetive conclusions in juxtaposition:—

Old Doctrines.	*New Doctrines.*
1. That vapour is both formed and decomposed during putrefaction.	1. That vapour is both formed and decomposed under the influence of high electrical conditions; but not during rot or putrefaction, carbon having then a greater affinity for oxygen than has hydrogen.
2. That snow and rain are nothing but congealed and condensed vapour, the ammonia of rain and snow water being acquired from the atmosphere, clouds being also nothing but vapour.	2. That snow is the original form of rain, is a quadruple compound, and during its decrystallization yields water, ammonia, and earbon, which carbon constitutes the black cloud, and by vegetating is transformed into the white cloud.

Entering the chemical class of the Mechanics' Institute with a mind in some degree accustomed to inductive reasoning, and at the same time repugnant to the carelessness of "taking for granted" whatever conclusions even his teachers might have arrived at, Franklin Coxworthy literally "began with the beginning" of his new study; and so simple appeared to him the principles of chemistry, that in a few weeks he so far mastered them as to be able to assist his class as a lecturer, according to the system of mutual instruction. He was then rapidly led to dissent from many of the received and otherwise undisputed opinions of that period; the first that especially engaged his attention being no less than the principles assumed to govern the decomposition of organic matter.

He was taught to believe by the chemieal authors of the day—Thenard, Henry, Ure, and others—that vapour was both formed and decomposed during the putrefaction of nitrogenous and the decay of vegetable matter; but, as it appeared to him that the same principle which caused the combination of the elements constituting vapour could not be safely assumed to effect their separation, he determined to appeal to experiment for a practieal decision.

Here, however, a difficulty presented itself, the want of pecuniary means, such as must still trammel his efforts in some degree. The chemical class did not possess appliances for the necessary investigation; and any arguments he could muster to induce the co-operation of the students in a crusade of this nature against the constituted authorities proved unavailing; and he was thus thrown upon the limited resources which his salary of £90 a year, as a clerk in the Ordnance-office, afforded beyond his subsistence, and the appearance he had to maintain as a Government employé.

It would be out of place for us to dwell, at this time, on the obstacles he had to contend with in conducting the numerous experiments which it became requisite for him to perform in elucidation of so important a question. Suffice it to say, that the necessarily protraeted labour of years—protracted through the want of those indispensable adjuncts, time and money—at length fully satisfied him that, during putrefaction and decay, vapour was neither formed nor decomposed. Had, however, his examination ended there, the labour would have been but ill re-

quited. In the course of his experiments he elicited the far more important fact, that during nitrogenous putrefaction atmospheric air is decomposed, but not during the decay of vegetable substances or non-nitrogenous matter; for the latter, when subjected to the action of pure oxygen, such as is evolved by plants, and which, having a greater specific gravity than air, falls to the ground, had the whole of its hydrogen evolved as a light carburet—the firedamp of coal mines. And here commenced inquiries which have terminated in results most interesting to science, and of corresponding consequence to the great human family of this ever-teeming world.

How, then, is this gas—the light carburetted hydrogen—restored to the vegetable kingdom? So the reader may now ask, as Franklin Coxworthy put the question to himself, when, being neither able to answer it of his own knowledge, nor to obtain a solution from any one else, he felt obliged, to use his own words, "to shut up shop," and trust to time and reflection to unravel the mystery. And Time the ripener, and Reflection the reaper, helped him to garner the harvest of the seed he had sown.

Returning homeward one morning from one of those walks before breakfast which invigorate the body and fructify the mind, he happened to turn round at the entrance of his humble domicile and take "a glance at the morning." It was a morning, too, in the month of May—the month of bright imaginings for the philosopher as well as the poet—when, the sun being well above a metropolitan horizon, Franklin Coxworthy observed in the west a magnificent white cloud majestically proceeding towards the north at the rate, apparently, of about two miles per hour; whilst, over the surface of that cloud, there was passing, at the rate of seemingly six or seven miles per hour, another very densely black. This black cloud, then, he reasoned cannot be vapour, since it is black by reflected light; and in that cloud he consequently and at once detected the carbon of the carburetted hydrogen! But, then, how came it there? Reasoning on the properties of the galvanic battery, which decomposes vapour, he came to the inevitable conclusion that there must be in nature some similar property, or, how else could that apparatus possess it? The utmost that man can do is partially to call into action the pre-existing principles of nature. He can only produce in mimic miniature the wonderful phenomena of the physical world. His highest efforts can but dimly illustrate the vast profundity of the mighty universe. And, following up his inductive reasoning, further reflection led Franklin Coxworthy's attention to the nitrogen evolved from the atmosphere during combustion and respiration; and, finally, he remembered, as the most conclusive corroboration of his discovery, that snow is deposited in altitudes far above the point of eternal frost in the atmosphere, and cannot, therefore, be congealed vapour, as we are informed by meteorologists.

He had, then, traced to the upper regions the gases of

Vapour { Oxygen, Hydrogen } Water

Carburetted Hydrogen { Carbon, Hydrogen } Carbon

Carburetted Hydrogen { Hydrogen, Nitrogen } Ammonia

or together a compound, being snow, which, on its decrystallization, yields water, ammonia, and carbon, which constitutes black clouds, and, by vegetating, the white clouds, and those of intermediate colours. In our next we shall convey this question a stage or two further.

Benjamin Aingworth, of Birmingham, button-maker, for improvements in ornamenting iron and other metals for use in the manufacture of gun barrels, and all other articles to which the same ornamented metals may be applied. Patent dated August 1st, 1849; six months.

David Clovis Knab, of Leicester-place, civil engineer, for an improved apparatus for distilling fatty and oily matters. Patent dated August 1st, 1849; six months.

CHEMICAL TABLES, ARRANGED FOR THE CHEMICAL TIMES,

By GEORGE CALEY, Esquire, 2, Mortimer-terrace, Notting-hill, Kensington.

Table IV.

TABLE OF THE MORE IMPORTANT BINARY COMPOUNDS OF THE METALS AND METALLOIDS, WITH THEIR NAMES, FORMULÆ, ATOMIC WEIGHTS ON THE OXYGEN AND HYDROGEN SCALES, AND THEIR PER-CENTAGE COMPOSITION.

[*Continued from page 57.*]

Names of Compounds.	Formulæ.	Atomic Weights on the Hydrogen and Oxygen Scales. H=1.	O=100.	Per-centage Composition.
Molybdenum	Mo	47.96	598.52	
Oxide	MoO	55.97	698.52=Mo	85.68—O 14.32
Binoxide	$Mo O^2$	63.99	798.52=Mo	74.95—O 25.05
Molybdic acid	$Mo O^3$	72.00	898.52=Mo	66.61—O 33.39
Chloride	Mo Cl	83.43	1041.17=Mo	57.49—Cl 42.51
Bichloride	$Mo Cl^2$	118.90	1483.82=Mo	40.34—Cl 59.66
Terchloride	$Mo Cl^3$	154.37	1926.47=Mo	31.07—Cl 68.93
Bisulphuret	$Mo S^2$	80.20	1000.85=Mo	59.80—S 40.20
Tersulphuret (sulphomolybdic acid)	$Mo S^3$	96.32	1202.02=Mo	49.79—S 50.21
Persulphuret (hypersulphomolybdic acid)	$Mo S^4$	112.44	1403.18=Mo	42.65—S 57.35
Nickel*	Ni	29.62	369.68	
Oxide	NiO	37.64	469.68=Ni	78.71—O 21.29
Chloride	Ni Cl	65.09	812.33=Ni	45.51—Cl 54.49
Sulphuret	NiS	45.74	570.84=Ni	64.76—S 35.24
Osmium	Os	99.72	1244.49	
Oxide	OsO	107.74	1344.49=Os	92.56—O 7.44
Sesquioxide	$Os^2 O^3$	223.48	2789.97=Os	89.24—O 10.76
Binoxide	$Os O^2$	115.75	1444.49=Os	86.15—O 13.85
Teroxide	$Os O^3$	123.76	1544.49=Os	80.58—O 19.42
Osmic acid	$Os O^4$	131.77	1644.49=Os	75.68—O 24.32
Chloride	Os Cl	135.19	1687.14=Os	73.76—Cl 26.24
Sesquichloride	$Os^2 Cl^3$	305.85	3816.93=Os	65.21—Cl 34.79
Bichloride	$Os Cl^2$	170.66	2129.79=Os	58.43—Cl 47.57
Terchloride	$Os Cl^3$	200.13	2572.44=Os	48.38—Cl 51.62
Sulphuret	OsS	115.84	1445.65=Os	86.08—S 13.92
Sesquisulphuret	$Os^2 S^3$	247.80	3092.47=Os	80.48—S 19.52
Bisulphuret	$Os S^2$	131.96	1646.82=Os	75.57—S 24.43
Tersulphuret	$Os S^3$	148.08	1847.98=Os	67.34—S 32.66
Palladium	Pd	53.36	665.90	
Oxide	PdO	61.37	765.90=Pd	86.94—O 13.06
Binoxide	$Pd O^2$	69.39	865.90=Pd	76.90—O 23.10
Chloride	Pd Cl	88.83	1108.55=Pd	60.07—Cl 39.93
Bichloride	$Pd Cl_2$	124.30	1551.20=Pd	42.93—Cl 57.07
Iodide	PdI	179.93	2245.40=Pd	29.66—I 70.34
Biniodide	PdI^2	313.63	3824.90=Pd	17.41—I 82.59
Sulphuret	PdS	69.48	867.06=Pd	76.80—S 23.20
Platinum	Pt	98.84	1233.50	
Oxide	PtO	106.85	1333 50=Pt	92.50—O 7.50
Binoxide	PtO^2	114.87	1433.50=Pt	86.05—O 13.95
Chloride	Pt Cl	134.31	1676.15=Pt	73.59—Cl 26.41
Bichloride	$Pt Cl_2$	169.78	2118.80=Pt	58.22—Cl 41.78
Iodide	PtI	225.41	2813.00=Pt	43.85—I 56.15
Biniodide	$Pt I^2$	351.97	4392.50=Pt	28.08—I 71.92
Sulphuret	PtS	114.96	1434.66=Pt	85.98—S 14.02
Bisulphuret	$Pt S_2$	131.08	1635.83=Pt	75.4—S 24.59
Potassium	K	39.26	489.92	
Oxide (potass)	KO	47.27	589.92=K	83.05—O 16.95
Peroxide	KO^3	63.36	789.92=K	62.02—O 37.98
Chloride	KCl	74.73	932.57=K	52.53—Cl 47.47
Iodide	KI	165.82	2069.42=K	23.67—I 76.33
Bromide	K Br	117.65	1468.22=K	33.37—Br 66.63
Fluoride	KF	57.99	723.72=K	67.69—F 32.31
Seleniuret	K Se	78.89	984.50=K	49.76—Se 50.24
Sulphuret	KS	55.38	691.08=K	70.89—S 29.11
Bisulphuret	KS^2	71.50	892.21=K	54.91—S 45.09
Tersulphuret	KS^3	87.62	1093.41=K	44.81—S 55.19
Quadrisulphuret	KS^4	103.74	1294.58=K	37.84—S 62.16
Pentasulphuret (persulphuret)	KS^5	119.86	1495.74=K	32.75—S 67.25
Rhodium	R	50.20	651.39	
Oxide	RO	60.21	751.39=R	86.69—O 13.31
Sesquioxide	$R^2 O^3$	128.43	1602.77=R	81.21—O 18.72
Chloride	R Cl	87.67	1094.04=R	59.54—Cl 40.46
Sesquichloride	$R^2 Cl^3$	210.80	2630.73=R	49.52—Cl 50.48

* There is also a sesquioxide of nickel ($Ni^2 O^3$). It does not unite with acids, however, to form salts; on ignition it is converted to protoxide, losing oxygen: with hydrochloric acid it produces protochloride, with evolution of chlorine.

TABLE IV.—(*Continued.*)

Names of Compounds.	Formulæ.	Atomic Weights on the Hydrogen and Oxygen Scales. H=1.	O=100.	Per-centage Composition.
SILVER	Ag	108.31	1351.61	
Oxide	AgO	116.32	1451.61=Ag	93.11—O 6.89
Chloride	Ag Cl	143.78	1794.26=Ag	75.33—Cl 24.67
Iodide	AgI	234.87	2931.11=Ag	46.11—I 53.85
Bromide	Ag Br	186.70	2329.91=Ag	58.01—Br 41.99
Sulphuret	AgS	124.43	1552.77=Ag	87.04—S 12.96

ON THE LIGNITES AND ALTERED DOLOMITES OF THE ISLAND OF BUTE.

By J. BRYCE, Jun., M.A., F.G.S.*

I. INTRODUCTION.

1. The only account which we possess of the geology of Bute is that given by Dr. M'Culloch in his "Description of the Western Islands of Scotland." During the thirty years that have elapsed since the publication of that work, no observations that I am aware of have been put on record, either supplementary to this account or in correction of it. Indeed the island seems to have been entirely overlooked; the superior grandeur and interest of the sister isle of Arran having wholly absorbed the attention of geologists. Yet Bute has many points of great interest in itself; and phenomena which in Arran are but obscurely shown are here fully exhibited. During a residence in the island for a part of last summer I had frequent opportunities of testing the accuracy of Dr. M'Culloch's account; and it is but justice to the memory of that distinguished geologist to say, that I have found the description of the phenomena to agree very closely with my own observations; and his work to be, here as well as in other places, a safe and pleasant guide.

II. CORRECTIONS AND SUPPLEMENTARY REMARKS.

2. The island of Bute is naturally divided into four portions, by three deep depressions or valleys, which traverse it perpendicularly to its greatest length. These low tracts terminate on either side of the island in deep bays, between which there can be no doubt, as well from the lowness of the ground as from the marine character of the materials of which these tracts are composed, the sea once flowed; thus forming three straits or narrow channels dividing Bute into four islands. From measurements made by Robert Chambers, Esq., and given in his beautiful and interesting work on "Ancient Sea-Margins," just published, it appears that these low tracts are about thirty feet above the present sea-level; an elevation very nearly the same as that of the flat region between Loch Lomond and the Clyde, in which we have the additional and more satisfactory evidence derived from shelly deposits.

Another interesting feature in the structure of Bute, and one intimately connected with the origin of the low tracts referred to above, is the terrace which surrounds almost the whole island at the height of between twenty and thirty feet above highwater mark, and along which the road is conducted throughout the greater part of the coast. The cliffs, which in many parts rise above this terrace, are often worn into caves, and bear other obvious marks of the action of the sea. This terrace is no doubt the former beach. It is well marked along the opposite coast from Gourock to Largs, in the Cumbrays, in Arran, and on most of the sealochs connected with the great estuary of the Clyde. Taking this along with other evidence accumulated by Mr. Smith, of Jordan-hill, in various papers, we cannot hesitate to admit that at a comparatively recent period such a change of level has been effected in Bute as to convert a detached group of islands separated by narrow straits into continuous land.

3. The valleys just described are the boundaries between dissimilar strata, the line of junction generally keeping the middle of the valley, but often concealed either by marshy ground or accumulations of shingle. The northern portion of the island, between the Kyles on one side and Kaimes and Ettrick bays on the other, is composed of mica-slate. The district south of this, bounded by the Rothsay Valley, presents siliceous and common clay-slate; while the portion extending from this valley to that of Kilchattan is occupied by red sandstone, usually conglomerate; and finally, the southern portion is composed of various rocks of the trap family erupted through the sandstone and overlying it. The connection of these strata with the mainland is most intimate. The slate and sandstone are the terminal portions of those great bands of sedimentary strata which extend from Angus to the Clyde, being parallel throughout to the granitic axis of the Grampian chain; while the erupted rocks in the south of the island are a prolongation of the great outburst of the igneous formations, which, affecting a general parallelism with the same axis, stretches from sea to sea in considerable ranges, as the Kilpatrick and Campsie hills, the Ochills, and some minor ridges in the south-east of Perthshire. The valleys intersecting the island seem obviously a part of that great system of parallel fractures which run in a north-east and south-west direction on both sides of the Grampians, and are probably due to the original upheaval of that chain, and partly to the subsequent eruption of the igneous rocks just mentioned through the old red sandstone, and the coal formation which rests upon it.

4. The strata of sandstone are fully exposed on the shore and in the cliffs from Rothsay to Ascog. South of Bogany Point limestone appears interstratified with the sandstone, the two rocks gradually passing into one another at the junction. Dr. M'Culloch describes one bed—I noticed several others; but the beds being thin, of small horizontal extent, and containing generally much siliceous matter, the rock is of little economical importance in this place. On the north side of the small rocky promontory south of Ascog-mill thin courses of nodular limestone traverse beds of brown shale. Subordinate to the sandstone, the shale is of considerable thickness, and appears again in the high banks above the road.

The south side of the same promontory presents the following strata:—The lowest bed is a fine-grained bluish-grey nodular limestone; it is succeeded by a black bituminous shale, containing veins of coal less than a quarter of an inch thick. A bed of concretionary limestone rests on the shale, the base or paste being a dark-coloured limestone, and the concretions rounded lumps of the same rock, often of considerable size. The upper part of the cliff is occupied by trap in various prismatic forms. By the contact of the trap, both the base itself and the imbedded lumps are so much altered as very closely to resemble the trap itself. The trap rock occupies a considerable area inland, and is upwards of 100 feet thick. Dr. M'Culloch has fallen into a slight error regarding it: he says, "When examined on the shore it appears rather to pass through the sandstone than to lie over it; but there is considerable obscurity in this place, as the lateral junction of the two is concealed by a cavity filled with earth." The junction is better exposed at present, probably in consequence of the continued action of the sea; and there can be no doubt that the relative position of the strata is such as above described. The trap reposes upon the sandstone, and does not pass through it.

5. The most considerable mass of limestone in the island occurs on the south side of Kilchattan Bay. Its characters are accurately described by Dr. M'Culloch, but he has mistaken its position. "This bed seems to lie over all the sandstone strata at this place, and to be the rock immediately in contact with the superincumbent trap." A little way above the limestone quarry, near the ruins of Kelspoke Castle, the beds of sandstone are distinctly seen dipping towards the trap, both the dip and inclination being the same as below the limestone; and it thus appears that the limestone is here, as in other parts of the island, subordinate to the sandstone, and of contemporaneous origin.

6. The limestone and shale which are interstratified with the sandstone in several places, and at Ascog are also accompanied by very thin veins of coal, bear a striking resemblance to true coal measures; and it is, therefore, not surprising that coal has been thought to exist in or under this sandstone, and that several attempts have been made to discover it. These, however, have been fruitless, and must always prove so, since there can be no doubt that the sandstone is the old red, and, therefore, inferior to the whole coal formation. The reasons for this opinion may be briefly stated.

(1.) Since in the adjoining tracts the series of rocks successively superimposed on the central granite is complete, and old red sandstone occupies in these its proper place, we may fairly infer that the sandstone which in Bute succeeds the slate series must be the old red. (2.) This sandstone, if continued on the line of its bearing, would coalesce with that which forms the Cumbrays, and with that which, rising to the west from beneath the great mineral basin of Ayrshire, skirts the coast from Ardrossan to Gourock, and from Toward Point to Dunoon, and appears again on crossing the Firth, in Dumbartonshire and Stirlingshire, forming the lower portions of the Kilpatrick and Campsie hills, and thus constituting a well-marked boundary between the coal basins of Lanarkshire and the primary ranges of the Highlands. (3.) The true coal formation associated with carboniferous limestone exists in Arran, separating distinctly the old red sandstone from the new. This old red sandstone of Arran encloses beds of limestone which are similar to those of Bute, and contain the same fossils as those limestones termed cornstones, which in England are subordinate to the old red system. Thus the red sandstone of Bute seems to be identified with the Devonian series of Arran and England. The evidence derived from fossils is unfortunately not applicable, as I was unable to find a trace of any organic substance either in the limestone, sandstone, or shale; and the same statement has been made by Dr. M'Culloch. It is probable, however, that organic remains will yet be found on a more extended and careful search.

III. THE LIGNITE BEDS.

7. The trap rocks at Ascog derive their chief interest from being the repository of beds of lignite; a substance so rare in Scotland that I believe no well-marked beds occur on the mainland, and but few in the other islands, and these in situations very difficult of access. I was led to a careful examination of this carbonaceous deposit by the statement of Dr. M'Culloch that some of the beds occurring here were unlike any he had seen in his survey of the Western Islands.

The principal bed is situated in the face of the cliffs above the road, a little to the south of Ascog-mill.

The lowest bed resting on the sandstone is a small-grained rudely columnar greenstone; the junction is, however, concealed. Over this is a trap-tuff with a base of greenstone, and imbedded spherical lumps of the same substance. This is followed by a bed of red ochre of coarse texture, traversed by numerous black iron

* Communicated by the author to "The Phil. Mag."

seams, which have doubtless been produced from a change in the oxidation of the component iron. Over this is the lignite bed. It is three feet thick, and consists of hard stony coal, interstratified with a yellowish-white shale, both being much intermixed with pyrites. The coal has been so much altered throughout its whole thickness by the contact of the trap rock that Mr. Rose, of Edinburgh, to whose examination I submitted the best specimens I could find, in order that he might determine the species of wood, but without mentioning the geological situation of the coal, was "unable to obtain a slice in consequence of the structure being altered by the contact of a whin dike." The coal has been worked to some extent by driving an adit inwards on the line of the dip, which is about 20° to the westward; but the workings have been for some time abandoned, and the inner and lower portions are now full of water.

The floor of the coal has been already described. The roof is a peculiar rock. It consists of a base or paste of an ochreous steatite, with imbedded round pieces of the same substance, and may hence be called a pisolitic ochre. It is three yards and a half thick. The bed above this is of the same character; but the base feels less unctuous, and with the imbedded steatite it contains also imbedded calcareous spar. The base effervesces briskly with an acid; and hence we may call the rock a calcareous amygdaloid. The upper portion of this bed, to the thickness of a few inches only, is very hard, and has a semivitreous appearance, and thus closely resembles a porphyry. In common with the trap above, and, indeed, all the beds in this locality, it contains much disseminated iron. The rest of the cliff is occupied by greenstone, which is the same as the lower bed resting on the sandstone.

Another bed of lignite occurs on the opposite or north-west side of the trap district, overlooking Aseog Lake. The coal dips to the interior of the area, that is, nearly south. It is of about the same thickness, and is accompanied by beds of steatite and red ochre, very similar to those above described; but the nature of the ground is such that a complete section cannot be had, and the precise number, therefore, and order of the beds cannot be exactly stated. The association, however, of the lignite with ochres and steatites here also is sufficiently distinct, and it is even probable that these beds are persistent throughout the whole of this district. It is to these ochreous and steatitic beds that Dr. M'Culloch refers when he says that he "has met with no similar substance among the numerous trap rocks examined in the course of the survey of the Western Islands." He has not, indeed, described any such strata; yet casual mention is made (vol. i., p. 376) of an iron-clay and jaspery substance, forming extensive beds in the trap of the cliffs of Talisker, in Skye—the same in which the lignite also occurs—and that these are often variegated with red, grey, and purple colours. No further description is given, nor is the precise position of the coal mentioned, the cliffs being very difficult of access.

But even by such a brief notice the steatitic beds and variegated ochres are easily recognised; and, though these characters are not very distinctly marked in the beds we have been describing in Bute, yet they apply exactly to the red and variegated ochres, which occur as members of the trap series of the north-east of Ireland. These rocks attain a much more complete development than in this country, both geographically and in relation to the number and variety of the beds. They extend continuously over an area of upwards of 1,000 square miles; and while the thickness is, on an average, about 300 feet, in very many cases it reaches to 1,100 or 1,200 feet. The whole series reposes on the chalk formation, while the corresponding rocks of this country rest upon the old red and carboniferous systems. Now, in this series the lignites occupy a determinate place; they occur in the middle region, associated with the steatites and variegated ochres, which are always largely developed wherever the series approaches to completeness. Instances may be seen at various points in the cliffs at the Giant's Causeway, at Ballintoy, at Glenarm, and at numerous places in the interior of the district. Similar beds are associated with the lignites of Bute and Skye, and most probably also of others of the Western Isles, though the notices are too vague to be relied on. We are thus led to the interesting conclusion that such association is not accidental, but has been determined by the prevalence over a considerable area of certain similar and fixed conditions, regulating the succession of the igneous eruptions, the mode of their consolidation, and the periods of repose during which the productions of the adjoining dry land were swept down and entombed.

IV. ALTERED DOLOMITES.

8. The dikes of Bute are composed of greenstone or basalt, and are extremely numerous. They traverse the different strata in every possible direction, and are well seen upon the rocky parts of the coast. All the usual phenomena are remarkably well exhibited by them, and can be studied together in a small space. Crystals of quartz and other substances are developed in the shale beds near the contact. The dikes can in some instances be traced continuously for several miles, preserving the same direction and the same width; two or more are sometimes seen to meet and coalesce for some distance, and again to separate; a narrow dike branches off into several filaments, which unite again; portions of the rock which is traversed are frequently found entangled in the dike; and these, as well as the contiguous strata, present the usual alterations now universally acknowledged to be the result of igneous action.

A remarkable change is produced on the Kilchattan limestone by one of these dikes. Its direction is very nearly the same as the dip of the limestone, and the effects are well seen at the eastern side of the quarry. Along the plane of contact with the dike the limestone is altered to the state of a granular saccharine marble, which on the application of a slight pressure crumbles into a fine powder. This is succeeded by a hard crystalline marble, the crystals appearing in distinct flakes. Between this and the first change, which is one of simple induration, there are many gradations. Similar effects are common at the contact of limestone with plutonic rocks; in some localities they are accompanied by other singular changes of a chemical nature. Magnesia, and sometimes silica and alumina, are introduced into the composition of the limestone, so that simple carbonate of lime becomes a double carbonate of lime and magnesia. The question whence this magnesia has been derived has occasioned much difference of opinion among geologists. Some imagine that it has been transferred from the plutonic rock to the limestone; while others hold that, as fractures and dislocations of the earth's crust accompanied the eruption of these plutonic rocks, gaseous exhalations might find their way from beneath, and introduce carbonate of magsia and other substances into rocks near the surface. In confirmation of this view, Mr. Phillips has shown, in his "Geology of Yorkshire," that "common limestone is dolomitized by the sides of faults and mineral veins far away from igneous rocks of any kind;" and some distinguished chemists have expressed their belief that carbonate of magnesia may be sublimed by the action of great heat. ("Rep. Brit. Assoc. for 1835, Trans. Sect.," p. 51; "Phillips's Geology," vol. ii., p. 98.) Much doubt, however, still hangs about this subject. Cases occur in which magnesia has been introduced, although the limestone could not have been subject to such a pressure as would confine its carbonic acid when the rock was softened by heat.

Being anxious to elucidate, if possible, this obscure subject, I submitted two specimens of the rock to Mr. John Macadam, lecturer on chemistry in this city, for examination with reference to the presence or absence of magnesia. The following is Mr. Macadam's report; the specimen referred to as No. 1 is the saccharine marble from contact with the dike; No. 2 is the unaltered limestone: both were average specimens:—

"I have carefully subjected to chemical analysis the specimen of limestone No. 1, with special reference to the presence or absence of magnesia; and I find from the indications given that carbonate of magnesia constitutes about 2½ per cent. of the whole mass. The mineral is not, therefore, a double carbonate of lime and magnesia. Its other and principal ingredients are carbonic acid and lime, besides which silica is present, as also traces of oxide of iron and alumina.

"In the specimen No. 2 I find magnesia in great abundance, the amount present being equivalent to 33.72 per cent. of carbonate of magnesia. The other constituents present are similar to those reported in No. 1. From the large proportions of carbonate of lime and carbonate of magnesia present in specimen No. 2, it would appear to be a species of dolomite. It may be noticed that the physical characters of No. 2 are very different from those of No. 1; the former is difficult to pulverize, the latter is extremely susceptible of division.

"The action of strong hydrochloric acid on both specimens causes a portion of gelatinous silica to appear, showing the presence of a silicate, which may be that of magnesia, since the quantity of gelatinous silica is about sufficient to combine with the 1.28 per cent. of caustic magnesia existing in the specimen No. 1. There is a less quantity of this gelatinous silica in No. 2. The greater portion, however, of the silica present in both specimens remains undissolved in the gritty or pulverulent condition, and is hence in a state of mere mechanical mixture with the other constituents of the limestone. It would require a minute quantitative analysis to determine whether the 1.28 per cent. of magnesia exists as a carbonate or silicate, or partly as both."

The phenomena are thus of a contrary character to what I had anticipated; the unaltered rock is a dolomite, and contains nearly 34 per cent. of carbonate of magnesia, while the altered rock contains less than three per cent. What has become of the constituent magnesia? Has it been driven off by the heat to which the limestone was exposed? Most chemists are unwilling to admit that this is possible; and it may reasonably be objected that, if the limestone had been exposed to so high a temperature as to vaporize its magnesia, the silica would not be mechanically present, but would have entered into chemical combination with the lime or the magnesia, and have formed a silicate.

That whin dikes have sometimes been the means of producing such a combination has been shown by an eminent chemist. In a valuable paper by Dr. Apjohn on the Dolomites of Ireland, published in "The Dublin Geological Journal," vol. i., the details of an analysis of the white chalk of Antrim, altered to the state of a saccharine marble, are given (p. 376); and it is remarked, in conclusion, that "the stone under consideration consists of silica, combined with the mixed oxides of calcium, magnesium, and iron (the carbonate of lime being mechanically present), and is, therefore, a mixture of trisilicates, very analogous in its composition to olivine. We are thus enabled to understand why olivine should be so very frequently found in trap rocks, and to refer its origin to the contact of silex at a high temperature with an excess of the basic oxides; and we have, in some degree, a demonstration that the dolomites which contain siliceous sand could not have been exposed at any time to a heat sufficiently high to account for the introduction into them of magnesia in the vaporous state; for by such a heat a silicate of lime or magnesia, or of both, would have been produced."

The presence of these silicates in both our specimens is shown by the gelatinous silica appearing; yet a greater quantity of silica is present mechanically, which, as already stated,

seems inconsistent with the exposure of the rock to intense heat; unless, indeed, we could suppose that the silica has been introduced by infiltration, or the magnesia removed by the solvent power of free carbonic acid at a period subsequent to the consolidation of the dike from a state of igneous fusion. But it is needless to pursue the subject further with our present limited knowledge of facts.

POSTSCRIPT.—ALTERED DOLOMITES.

The preceding account was drawn up some months ago for insertion in "The Philosophical Magazine." On consideration, however, it was thought best to withhold it until careful quantitative analyses of the limestones should be obtained. This has now been accomplished through the kindness of Dr. Robert D. Thomson, of Glasgow University, of whose skill and competence it would be presumption in me to speak. It is hoped that these will afford definite terms of comparison with other analyses, such as those of Dr. Apjohn already referred to; and that their publication may lead to the formation of clearer views respecting an obscure question in theoretical geology.

The analyses kindly furnished me by Dr. Robert D. Thomson are as follows:—

Specimen No. 1 is the saccharine marble from contact with the dike at Kilchattan,—in the highest state of alteration.

No. 2 is the hard crystalline marble, having the crystals in distinct flakes, more remote and less altered than No. 1.

No. 3 is the unaltered limestone from the middle of the quarry, remote from the dike,—an average specimen.

No. 4 is the altered limestone from contact with the overlying trap at Ascog-mill; it is an impure dark-coloured rock of an earthy aspect, and very like the trap which rests upon it.

No. 1. Spec. grav. 2.710.

	By Mr. J. H. Turnbull.	By Mr. Henry S. Thomson. I.	II.
Silica ..... Alumina	6.91	5.15	5.17
Protoxide of iron	1.68	1.50	1.28
Carbonate of lime.....	90.65	..	91.08
Carbonate of magnesia ..	1.00	..	1.17
	100.24		99.23

No. 2. Spec. grav. 2.570.

		I.	II.
Silica..... Alumina.....	1.94	0.28	0.28
Protoxide of iron	0.52	..	0.56
Carbonate of lime.....	96.48	98.76	96.58
Carbonate of magnesia...	1.23	..	2.24
	100.17		99.66

No. 3. Spec. grav. 2.679.

	I.	II.	
Silica..... Alumina.....	9.70	..	9.08
Protoxide of iron	1.12	..	1.12
Carbonate of lime.....	67.42	72.12	67.00
Carbonate of magnesia...	17.31	..	18.06
Water, coaly matter, and carbonic acid. ..	4.45	..	4.74
	100.00		100.00

No. 4.

Silica..... Alumina.....	64.21	64.46
Protoxide of iron	6.42	6.60
Carbonate of lime.....	24.00	21.20
Carbonate of magnesia. .	4.62	2.85
Water and carbonic acid.	1.75	4.89
	100.00	100.00

The silica present is in a state of mechanical mixture.

These analyses are confirmatory of the main points of the views already stated, and seem clearly to establish the new and remarkable fact, that by the igneous action in these instances the magnesia has been driven off from the limestone. The unaltered rock is a dolomite containing nearly 70 per cent. of carbonate of lime, and nearly 20 per cent. of carbonate of magnesia; while the altered rock contains but from 1 to 2 per cent. of the latter ingredient. To what cause are we to assign the changes that have taken place? Has the magnesia been sublimed by heat? or has it been withdrawn by the solvent power of free carbonic acid? On the nature of these and the other chemical changes that have been induced I do not feel myself competent to express an opinion; and from such limited premises it would be unphilosophical to draw any general conclusions. The subject is one, however, of great interest both to the geologist and chemist, as the facts are directly opposed to the received views; and as no instance of similar changes on dolomitic rocks has, so far as I am aware, ever been put on record.

ON A SERIES OF INSOLUBLE ALKALINE SALTS OF PHOSPHORIC AND ARSENIC ACIDS.

By H. ROSE.

Of the double salts of the earthy and alkaline phosphates insoluble in water, the ammonio-phosphate of magnesia was the only one hitherto known; but perfectly analogous double salts of potash and soda, as also of lithia, both with magnesia and lime, can be produced. These double salts are formed on fusing phosphate of lime or magnesia with an excess of carbonated alkali; but they cannot be obtained pure in this way, as a partial decomposition always takes place from the great excess of the alkaline carbonate. The higher the temperature at which the decomposition occurs, and the more perfect the whole becomes liquid, the greater is the amount of earthy phosphate decomposed. In fact, perfect decomposition may result under certain conditions with the phosphate of magnesia; but this never obtains with the phosphate of lime, and the reason of this is, that the double salt of alkaline phosphate and phosphate of lime is decomposed with great difficulty by the alkaline carbonate.

When, however, the earthy phosphates are well mixed with a small quantity of carbonated alkali, and then heated so that the mass neither melts nor can cake together, the whole of the carbonic acid is expelled from the alkali, and the latter cannot be completely removed from the calcined compound either by cold or by hot water. It is, however, difficult to obtain these compounds in a state of great purity, which depends partly on the quantity of carbonated alkali employed; if too little is used, a compound is obtained mixed with excess of earthy phosphate, whilst if too much is employed a slight decomposition may occur, and the compound then contains more or less earthy carbonate. But the composition of the compound likewise depends partly on the length of the washing, by which they are more or less altered.

In general one atom of the earthy pyrophosphate was mixed intimately with one atom of the alkaline carbonate, and the mixture calcined until no further loss in weight resulted. The calcined mass had not fused nor caked together; it was heated for some time with water, and then washed with hot water.

On analysis the compounds were found to consist more or less accurately of two atoms of earth, one atom of alkali, and one atom of phosphoric acid; and the oxygen of the bases was to that of the phosphoric acid as 3 : 5.

In most cases the washing required considerable time; in some cases it was almost impossible to accomplish it. It was then found that the alkali was very tenaciously retained, but that a large, frequently the largest, portion had been removed from the earthy phosphate by the washing. In these cases the alkali is replaced by an equivalent of water, so that such a compound, after having been washed a long time with hot water, consists partially of the still undecomposed original compound, but partially of a new one consisting of two atoms of earth, one atom of water, and one atom of phosphoric acid, both compounds mixed or combined with each other. When, in the preparation, an excess of carbonated alkali has been used and the earthy phosphate fused with it, the washed compound is mixed with larger or smaller quantities of earthy carbonate. The water which has been used for the washing never presents the least trace of carbonic acid unless an excess of alkaline carbonate has been employed, but always larger or smaller traces of alkali. But sometimes some of the earthy phosphate is dissolved by the washing, and the presence of phosphoric acid and of the earth can be detected in the wash-water by reagents. In this case the compound was washed with water to which a little ammonia had been added.

Nearly all the salts examined exhibited a crystalline structure under the microscope. For analysis the compounds were dried at 212°, and a portion then calcined. In many cases this occasioned a slight loss in weight, which arose from water, as the other portion of the dried salt, treated with nitric acid in a suitable apparatus for determining carbonic acid, gave off in most cases none or the merest trace of carbonic acid. Only in a few cases did carbonic acid (as earthy carbonate) form an essential constituent, or rather admixture, of the compound; but in such cases, as above observed, more alkaline carbonate had been employed to produce the salt than requisite. In such cases the wash-water contained larger quantities of phosphoric acid, and the amount of alkali in the insoluble compound was smaller in proportion.

In order to separate the bases from the phosphoric acid, the solution of the salts in nitric acid was treated with metallic mercury. The earths were separated from the alkalis according to the usual methods.

Phosphate of Potash and Lime, $KO + 2CaO + PO_5$.—The compound, dried at 212°, experienced no loss at a gentle red heat. After estimating the carbonic acid by means of nitric acid in a small apparatus, the bases were separated by mercury as above described. The following results were obtained:—

		Oxygen.		Calculated according to the Formula:
Lime.....	32.71	9.18	13.51	32.19
Potash	25.59	4.33		26.96
Phosphoric acid	39.73	22.26		40.84
Carbonic acid ..	0.66			

A slight decomposition had been occasioned by a very small excess of carbonate of potash, and some carbonate of lime formed. In other respects the calculated composition agrees very well with that found.

Phosphate of Soda and Lime, $NaO + 2CaO + PO_5$.—In one experiment to prepare the salt the quantity of carbonate of soda used was much greater than required; the calcined mass had become caked together, and the wash-water contained a considerable amount of phosphoric acid. In a second experiment (II.) the requisite quantity of carbonate of soda was employed:—

	I.	Oxygen.	
Lime	40.17	11.23	12.60
Soda	5.17	1.32	
Phosphoric acid .	41.39	23.19	
Carbonic acid ..	13.49		
	II.	Oxygen.	
Lime	35.27	8.56	14.34
Soda	19.12	5.76	
Phosphoric acid .	44.90	26.28	

A third experiment was made to ascertain whether, on fusing phosphate of lime with a large excess of carbonate of soda, the resulting compound, washed with water, would contain alkali. This salt, dried at 212°, gave:—

	III.	Oxygen.
Lime	47.60	13.37
Soda	5.25	1.34
Phosphoric acid	33.15	18.57
Carbonic acid	9.11	6.59
Water.....	4.89	4.34

The water was determined from the loss, as it could not be found by ignition, owing to the presence of carbonate of lime. The compound contained a considerable quantity of carbonate

of lime mixed with it, and, besides the compound $NaO + 2CaO + PO_5$, nearly three atoms of $HO + 2CaO + PO_5$. The analysis shows an excess of water; it is, however, found by the loss, and is consequently made up of all the small losses of the other constituents.

Phosphate of Potash and Strontia, $2SrO + KO + PO_5$.—The compound, dried at 212°, experienced no perceptible loss on ignition. It afforded:—

		Oxygen.	Calculated according to the above Formula.
Strontia	49.33	7.62	46.59
Potash	17.62	2.98	21.24
Phosphoric acid	34.01	19.08	32.17

Some potash has been removed from the compound by the washing.

Phosphate of Soda and Strontia:—

		Oxygen.
Strontia	53.44	8.25
Soda	10.16	2.59
Phosphoric acid	34.61	19.39
Water	1.72	1.53

The per-centage composition of a compound represented by the formula $NaO + 2SrO + PO_5$ would be:—Strontia, 50.19; soda, 15.15; and phosphoric acid, 34.66. The compound examined corresponds very closely to the formula $2(NaO + 2SrO + PO_5) + (HO + 2SrO + PO_5)$, which would require:—

Strontia	52.07
Soda	10.47
Phosphoric acid	35.95
Water	1.51

Phosphate of Potash and Baryta.—This compound appears to be more decomposed by treatment with water than all those hitherto described. It furnished on analysis:—

		Oxygen.
Baryta	70.23	7.34
Potash	1.55	0.26
Phosphoric acid	26.95	15.10
Water	2.36	2.09

It appears as if the phosphate of baryta, which was employed as $2BaO + PO_5$, had only been deprived of phosphoric acid by ignition with carbonate of potash, and had become converted into $3BaO, PO_5$. The compound moreover contains some $KO + 2BaO + PO_5$ and $HO + 2BaO + PO_5$.

Phosphate of Soda and Baryta.—The compound, dried at 212°, gave:—

		Oxygen.	Calculated according to $NaO, 2BaO + PO_5$.
Baryta	65.45	6.83	59.85
Soda	7.10	2.04	12.28
Phosphoric acid	26.54	14.86	27.87
Water	1.07	0.95	

It had, therefore, been somewhat decomposed by water, and contained, besides $NaO + 2BaO + PO_5$, some $HO + 2BaO + PO_5$.

Phosphate of Potash and Magnesia.—Only slight traces of phosphate of magnesia dissolved on washing the salt which had been calcined with carbonate of potash. The compound, dried at 212°, had the following composition:—

		Oxygen.	Calculated according to $KO, 2MgO + PO_5$.
Magnesia	28.45	11.01	25.85
Potash	22.15	3.75	29.48
Phosphoric acid	46.88	26.26	44.67
Water	2.52	2.23	

In this case some potash has been removed by washing and replaced by water.

Phosphate of Soda and Magnesia:—

		Oxygen.
Magnesia	34.82	13.47
Soda	11.75	3.00
Phosphoric acid	45.00	25.21
Water	8.13	7.20

This compound contains $NaO + 2MgO + PO_5$ and $3MgO + PO_5$. It is difficult to account for the large amount of water.

Phosphate of Lithia and Lime.—For these experiments pure carbonate of lithia was employed perfectly free from potash and soda. As is well known, the carbonate of lithia is essentially distinguished from the carbonate of potash and soda by a very peculiar property. When fused in a platinum crucible it acts upon it, and the platinum acquires a liver-brown coating where the readily-fusible salt was in contact with it. On the discovery of lithia great importance was attached to this property, and it was considered to furnish a distinctive character between lithia and the other fixed alkalis. Only the carbonate of lithia has this property, and none of the other readily-fusible salts of lithia. In those compounds, for instance, the silicates, in which the presence of lithia was suspected, it was customary to fuse them before the blowpipe with carbonate of soda upon platinum foil; subsequently, however, it was found that the coating of the platinum in this case was a very uncertain test for lithia, since pure carbonate of soda fused upon platinum foil frequently produced a similar appearance. The brown coating of the platinum disappears when the spot is washed with water and heated to redness, but the metal has lost its polish and become deadened.

This colouring of the platinum on fusion with carbonate of lithia arises from its losing some carbonic acid at a red heat; the lithia, the moment it is liberated, causes the platinum to oxidize, and combines with the oxide in a similar manner, as is the case with potash and soda when they are set free, or when they act as hydrates at a high temperature upon platinum. The ready fusibility of the carbonate of lithia favours the oxidation of the platinum far more than when the carbonates of the alkaline earths are heated in a platinum crucible to intense redness.

The loss in carbonic acid which the carbonate of lithia experiences is not very considerable; 0.603 grm., after being fused six times, only decreased 0.023 grm. One atom of carbonate of lithia was heated with one atom of phosphate of lime ($2CaO, PO_5$); the whole of the carbonic acid was expelled. The compound, dried at 212°, furnished:—

		Oxygen.	$LiO, 2CaO + PO_5$ requires
Lime	41.53	11.76	39.58
Lithia	9.03	4.98	10.22
Phosphoric acid	50.69	28.39	50.20

When the earthy phosphates are fused with alkaline chlorides, chlorine is expelled on the access of moist air as hydrochloric acid, and compounds similar to those above described are formed.

When, however, earthy phosphates are contained with alkalis in acid solutions, the former can be precipitated by ammonia without the precipitate containing alkali. These compounds, therefore, are not formed in the humid way; the whole amount of the earthy phosphate, however, is not precipitated.

Besides the phosphates above described, others appear to be formed under certain circumstances, which, perhaps, consist of two atoms of an alkali, one atom of an earth, and one atom of phosphoric acid. They are soluble in water. When an organic substance is carbonized and the charred mass is exhausted with water, the aqueous solution very frequently contains earthy phosphates (especially phosphate of lime), which separate when the liquid is evaporated to dryness and the residue is dissolved in water. The earthy phosphates are held in solution by the alkaline phosphates, with which they have formed soluble double salts.

When an excess of pyrophosphate of soda is heated to a faint red with carbonate of lime, the aqueous solution of the ignited mass contains phosphate of lime. The presence of lime can instantly be detected by oxalic acid in the aqueous extract. The phosphate of lime does not separate well when the aqueous extract is evaporated to dryness, or when a current of carbonic acid gas is passed through it; but it is entirely deposited when carbonate of soda is added to the liquid and then evaporated. The separated phosphate of lime contains no carbonate of lime after washing. Evidently a soluble double salt of phosphate of soda and phosphate of lime is formed; the latter separates when a portion of soda in the solution is converted into carbonate.

Arseniate of Potash and Magnesia.—Dried ammonio-arseniate of magnesia was kept at a gentle heat until the whole of the water and ammonia might be assumed to be expelled; it was then intimately mixed with one atom of carbonate of potash and heated to redness in a porcelain crucible. The calcined mass, which had not caked together, was boiled with water and well washed; the washing was effected with water containing some ammonia. The filtered liquid contained a large amount of arsenic acid; the residue, which had been washed for a very long time, gave a copious evolution of carbonic acid on treatment with hydrochloric acid; however, the solution, upon being supersaturated with ammonia, furnished a large precipitate of arseniate of ammonia and magnesia. Another portion of the solution, mixed with alcohol and chloride of platinum, produced but a very slight precipitate of the potassio-chloride of platinum. The earthy arseniates are far more perfectly decomposed than the phosphates by fusion with alkaline carbonates. The decomposition would have been complete had a larger amount of carbonate of potash been used; for even a small amount decomposed a very considerable quantity of the arseniate of magnesia; nevertheless a compound, $KO + 2MgO + AsO_5$, had been produced, which was decomposed by the water.

Arseniate of Soda and Magnesia.—This compound was boiled with water, and washed with water containing a little ammonia. The filtered liquid contained no carbonic acid, but a large amount of arsenic acid. The compound did not exhibit a trace of carbonic acid on treatment with nitric acid. The bases were separated with metallic mercury. To estimate the arsenic acid, another portion of the compound was dissolved in muriatic acid, and the solution supersaturated with chloride of ammonium and ammonia. From the precipitate of ammonio-arseniate of magnesia the amount of arsenic acid was calculated; the filtered liquid contained not a trace of arsenic acid. The arseniate of magnesia can, therefore, be entirely precipitated by ammonia, which is not the case with the (pyro)phosphate of magnesia. Analysis gave:—

		Oxygen.	$NaO, 2MgO + AsO_5$ requires
Magnesia	24.28	9.40	22.02
Soda	11.50	2.94	16.62
Arsenic acid	57.52	19.97	61.36
Water	6.70		

The water is determined from the loss. It is seen from this examination that, on heating arseniate of magnesia and carbonate of soda, a portion of the former is decomposed; arseniate of soda and carbonate of magnesia are formed, which, however, on calcination is wholly deprived of its carbonic acid. The mass treated with water evidently contained the compound $NaO + 2MgO + AsO_5$; which, however, was partly converted, by treatment with water, into $HO + 2MgO + AsO_5$, and pure magnesia produced from the carbonate.—*Poggendorff's Annalen*, June 14, 1849, and *Chemical Gazette*.

PRACTICAL APPLICATION OF THE LAW POINTED OUT BY DR. R. D. THOMSON OF THE PROPER BALANCE OF THE FOOD IN NUTRITION.

By Dr. C. REGIMIUS FRESENIUS,

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In reference to the question concerning the relation which must subsist between the nitrogenous and non-nitrogenous nutritive substances in the food of men and animals, it is but due to Dr. R. D. Thomson to acknowledge, that he

* Translated from the "Lehrbuch der Chemie für Landwirthe, Forstmänner und Cameralisten von Dr. C. Regimius Fresenius (1847)," page 480, by William Augustus Perston.

considers this the most important circumstance in nutrition, and was the first to call attention to it.

This relation is obviously different in various classes of animals, and besides it must be different even in the same class of animals, according to their mode of life and to the amount of exercise they undergo.

An animal which is hard worked will require a different proportion to one which stands at rest in a stable; still more different must be the proportion when our object is to fatten the animal. I consider it to be one of the most important tasks of dietary and the feeding of cattle to fix the requisite proportions suited to the various modes of life, for it may be understood that these limits cannot be overstepped on either side without injury.

Let us suppose, for instance, an animal requires under certain circumstances the proportion of 1 nitrogenous (nutritive) to 5 non-nitrogenous (calorifiant) constituents in its food; but, if we give it food in which the proportion of 1 to 10 prevails, there will be, in the process of nutrition, for every 1 part nitrogenous only 5 parts non-nitrogenous assimilated; the other half of the non-nitrogenous (calorifiant) aliment will be wasted.*

But it is not the pecuniary loss alone which arises through this that deserves consideration; for it is clear that the animal will be burdened with the process of getting rid of the unassimilated half; for this object strength is required, which might otherwise have been spared.

If we give it food containing too large a proportion of nitrogenous aliment, in favourable circumstances it will consume the dearer instead of the cheaper non-nitrogenous aliment; but in unfavourable circumstances it will become diseased, by being compelled to act in opposition to nature.

Taking it for granted that the requisite proportions for different circumstances were ascertained, the choice of aliment could be regulated on the most rational basis.

[We speak here primarily only of the absolute strength of nourishment, without noticing the greater or less degree of digestibility possessed by equally nutritious substances, and the proportion of unassimilable constituents which they contain.]

We observe, for instance, that cows on a meadow, feeding only upon grass, enjoy good health. Now, let us endeavour to ascertain how we can produce the same proportion of non-nitrogenous and nitrogenous aliment with other descriptions of food.

The proportion which exists in grass or hay is 1 to 8.3, as in the following table:—

	Relation of 1 part nitrogenous to non-nitrogenous. I.	Relation of 1 part nitrogenous to salts. II.	The following quantities contain 1 part of nitrogenous matter. Nitrogenous, non-nitrogenous, and salts. III.	Dried at 212°. IV.	Dried in air. V.	Fresh substances. VI.
French beans	1.81	0.15	2.96	3.45	4.00	
Lentils	1.87	0.09	2.96	3.45	4.00	
Field beans	2.08	0.15	3.23	3.66	4.29	
Peas	2.14	0.11	3.25	3.66	4.28	
Wheat	2.42	0.11	3.53	4 21	4.85	
Oats	4.08	0.24	5.32	6.41	7.35	
Barley	4.25	0.27	5.52	6.53	7.57	
Rye	4.42	0.13	5.55	6.29	7.24	
Red turnips	5.08	0.42	6.50	6.45	..	35.3
Red clover	6.08	0.60	7.68	7.68	9.72	32.0
White turnips	6.39	0.55	7.94	7.91	..	65.1
Indian corn	6.55	0.10	7.65	8.13	9.34	
Mangel-wurzel	7.26	0.44	8.70	8.65	..	48.8
Carrots	7.84	0.55	9.39	9.39	..	67.6
Meadow-grass	8.30	0.73	10.03	10.73	12.47	32.8
Potatoes	9	0.40	10.40	..	..	41.2
Oat-straw	12.5	2.04	15.54	40.00	55.55	
Wheat-straw	14.2	2.48	17.68	40.00	54.05	
Rice	14.8	0.10	15.90	16.61	18.41	
Rye-straw	24.4	1.93	27.33	53.48	65.79	
Barley-straw	29.3	3.08	33.38	52.35	58.82	
Cherries	41	0.18	42.18	..	..	175.4
Pears	121.6	0.40	123.00	..	..	1250

This table, as given by Fresenius, is derived from German authorities, including several results obtained and published by Dr. Thomson in his "Researches on Food," p. 167. See also "Phil. Mag.," vol. xxxii., p. 459. There is, therefore, some discrepancy when compared with English grain, the German grain being richer in nitrogen. See Dr. Thomson on the Composition of German and English Bread, "Phil. Mag.," vol. xxiii., p. 321.

Were we then to give them carrots, in which 1 part nitrogenous is contained for every 7.84 parts of non-nitrogenous constituents, the proportion would not be materially disturbed; but were we to give them potatoes (1 : 9) we disturb the proportion somewhat more. It is, therefore, expedient to feed them with a substance which is richer in nitrogen; this proper proportion may be obtained with exactness by mixing 1 nutritious equivalent of red clover with 3 nutritious equivalents of potatoes:—

$$1 \times 1 : 6 \quad = 1 : 6$$
$$3 \times 1 : 9.00 = 3 : 27$$
$$4 : 33 \text{ or } 1 : 8.25.$$

To produce this mixture we feed them by giving them 9.7 lbs. of dried clover for every 123.6 lbs. of potatoes.

If we wished to give them the same proportion in white turnips and oat-straw, we must supply for every 2 nutritious equivalents of the former 1 nutritious equivalent of the latter; for this mixture gives the proportion of 1 to 8.4; that is, they must be fed with 130 lbs. of fresh white turnips for every 55.55 lbs. of dried oat-straw.

A horse that works hard requires the proportion of 1 to 4. For this we give him oats which represent that proportion. But, if we wished to give him the same proportion in field beans and hay, we must take for every 2 alimentary equivalents of the former 1 alimentary equivalent of hay, for such a mixture has the proportion of 1 to 4.1. We feed him, therefore, with 8.58 lbs. of dry field beans for every 12.47 lbs. of dry hay.

A man requires, for a certain mode of life, the proportion of 1 to 3. He wishes to eat beef and potatoes; he must, therefore, for every 2 alimentary equivalents of beef eat 1 alimentary equivalent of potatoes, for this mixture gives the proportion of 1 to 3.01; he must, therefore, use for every 2 lbs. of boiled beef (reckoned without water) 41 lbs. of potatoes (reckoned in the fresh state).

If he wished to produce the proportion of 1 to 4 with carrots and raw bacon, he will attain it by mixing 5 alimentary equivalents of the former with 6 alimentary equivalents of the latter, which represent the proportion of 1 to 3.99. For this purpose he must eat 338 parts of fresh carrots for every 11 parts of raw bacon (reckoned free from water).

Concerning the question, as to what is the proper quantity of aliment (possessing the due proportions) which is to be given under different circumstances, experience alone can determine it. For the computation, how the necessary quantity may be given in diverse properly assorted alimentary mixtures, we would refer to the divisions III., IV., V., and VI. of the foregoing table.

If a cow requires in twenty-four hours 10 kilogrammes (22.05 lbs. avoirdupois) of air-dried hay, how many kilogrammes of the mixture given above of clover and potatoes would it require to replace it?

10 kilogrammes of air-dried clover contain in all 8.04 kilogrammes (17.728 lbs. avoirdupois) of nutritious matter, for

$$12.47 : 10.03 = 10 : x$$
$$x = 8.04.$$

That mixture will consist of 9.7 kilogrammes (21.38 lbs. avoirdupois) of dry clover, which contain in all 7.68 kilogrammes (16.93 lbs.) of nutritious matter and 123.6 kilogrammes (272.5 lbs.) of potatoes, which contain in all 31.20 kilogrammes (68.79 lbs.) of nutritious matter.

133.3 kilogrammes (293.93 lbs.) of the mixture contain accordingly 38.88 kilogrammes (85.72 lbs.) of nutritious matter.

38.88 kilogrammes (85.72 lbs.) of the joint nutritious matters are equal to 133.3 kilogrammes (293.93 lbs.) of the mixture. How many are 8.04 equal to? $x = 27.5$ (60.63 lbs.).

27.5 kilogrammes (60.63 lbs.) of the mixture in question are equivalent to 10 kilogrammes (22.05 lbs.) of hay in the proportion and quantity of nitrogenous and non-nitrogenous alimentary substances. In a precisely similar manner the kind and quantity of the salts must be attended to in practice.

CONCLUSIONS FROM THE FOREGOING.

We have approximated much more closely to the object we had in view, viz., a completely rational system of nutrition, than it has hitherto been possible to do, and can answer the proposed questions with perfectly accurate average numbers; and we have now only duly to consider the influence which the unappropriated portions of food exert on the body (the getting rid of them involves a waste of strength); and further, the greater or less degree of digestibility (*der leichteren oder schwereren, schnelleren oder langsameren Verdauliehkeit*) of each species of aliment, in order to do it with perfect precision.

But we can even now, from what has already been stated, educe safe and weighty conclusions, namely, the following:—

1. It is an impossibility to sustain either a man or a beast on food entirely devoid of nitrogen, however great in quantity it may be.

2. All that has been said in the older as well as in many of the newer books on husbandry, respecting the relative nutritive value of different kinds of forage, cannot, inasmuch as it was not arrived at by experience, but deduced from theoretical views, possibly be correct, because these views do not accord with facts.

3. The discovery of the true relative value of aliment, and of the proportion in which it may

* The original passage is "So wird es beim Ernährungsprocesse auf je 1 Thl stickstoffhaltige eben doch nur 5 Thle stickstoffreie Bestandtheile verwenden, die andere Hälfte der stickstoffhaltigen Nahrungsmittel wird vergeudet." The true reading it is apprehended ought to be *stickstoffreie Nahrungsmittel*, and it has thus been rendered in the English version.—TRANS.

be replaced, may be ascertained without much difficulty, so long as chemists and farmers work hand in hand for the exact solution of the above questions.

4. A completely rational system of nutrition, that is such an one as combines the greatest amount of strength with the least consumption of nourishment, will then be possible.

5. A loss of nutritious matter and of strength often takes place where it would be least expected, namely, by the consumption of all kinds of food (or forage) where the due proportion between nitrogenous and non-nitrogenous constituents does not exist, say by eating only fruit or potatoes.

6. It can with safety be decided by the above under what circumstances substitutes for bread may be employed, and what is their respective value for each desired proportion.

RAW AND COOKED ARTICLES OF FOOD.

Many kinds of food cannot be eaten raw by man; others, although they may be eaten raw, agree much better with us when cooked.

Hence boiling, roasting, baking, &c., has a twofold effect; primarily, it converts indigestible or food difficult of digestion into a digestible or more easy digestible condition. Thus, stareh is converted into gelatinous starch, into dextrine or sugar; cartilaginous substances into glue; and chondrine, fibrine, into changed fibrine, &c. Secondly, it frequently confers upon them an agreeable taste.

But can the real nutritive value of food be augmented by cooking? Impossible! Still it may be of the greatest benefit in feeding cattle to cook their food. The advantage accrues in this way, that potatoes, turnips, &c., are more quickly and more easily digested when boiled than raw; and thus there is much less chance for any portion to be thrown off in an undigested state (unassimilated). Its warmth gives also a slight advantage to cooked food; it deprives the body of no heat; and the non-nitrogenous substances, which in the cold food would have been required to afford heat, can be used for the production of fat. But whether cold or warm food is to be preferred in a practical point of view cannot from all this be conclusively deduced. It is a question only to be answered by experience, for the result is entirely dependent on the nature and requirements of the animal.

ON THE FORMATION OF FATTY MATTERS IN VEGETABLES.

By M. BLONDEAU DE CAROLLES.

M. Blondeau de Carolles remarks it as well known that oleaginous grains do not, in an early stage of their development, contain any trace of fatty substances; and that it appears evident that the latter are formed from the substances originally entering into the constitution of these grains. The author was desirous of determining which are the principles the transformation of which gives rise to the fatty bodies, and the mode in which it is effected.

The author especially studied the formation of oil in the olive. This fruit, carefully analyzed, yielded scarcely an appreciable trace of nitrogen; it was not, therefore, owing to the presence of vegetable albumen or caseine, neutral nitrogenous bodies contained in oleaginous grains, the transformation of which, according to MM. Liebig and Dumas, is sufficient to explain the formation of fatty substances.

The elements of this transformation must then be sought for in a body analogous in composition to fecula, sugar, or lignin.

The analyses of olives, at first performed in an early state, and afterwards as they approached maturity, showed that in the former condition they contained no trace of oil; but that, from the moment at which the oil began to appear till the fruit had attained its complete development, the proportion of tannin, and especially of lignin, gradually diminished as that of the oily liquid increased.

From these circumstances the author concludes that the formation of oil in the olive is the result of the reciprocal action of tannin and lignin, and experiment seemed to confirm this explanation. Some olives confined in a graduated receiver full of mercury disengaged after a few days pure carbonic acid gas, and the sides of the receiver were covered with the [condensed?] vapour of water.

The carbonic acid was four times greater in volume than that of the olives from which it was produced; and it could be formed only at the expense of the elements contained in the fruit, the external air being excluded.

The following formulæ explain the phenomena described in a satisfactory manner:—

$$3(C_{12}H_{12}O_{12}) + C_{18}H_8O_{12} = C_{36}H_{36}O_4 + C_{18}O_{36} + H_8O_8.$$

Lignin. Tannin. Oil. Carbonic acid. Water.

This explanation was verified by experiment.

The analyses of the oil extracted from olives which had served for experiment gave the following results:—

Oil 0.361.		Carbonic acid 1.043.	Water 0.377.	
Carbon..	78.66	According to the formula $C_{36}H_{36}O_4$ there should be obtained	C	76.05
Hydrogen	11.39		H	12.95
Oxygen..	9.95		O	11.00
	100.00			100.00

These numbers approach each other sufficiently near to admit the formula as expressing one of the most curious transformations presented by organic chemistry.—*L'Institut*, Juin 20, 1849.

ON THE PREPARATION OF PURE OXIDE OF COBALT.

By M. LOUYET.

The author observes that chemists are generally aware that nothing is less easy than to separate oxide of cobalt from the iron and nickel which it contains; on this account the oxide of cobalt is rarely met with in commerce perfectly free from all traces of these metals.

Among the methods which have been proposed to obtain from cobalt ores the oxide perfectly free from iron and nickel, M. Liebig's appears to have been preferred. This process, which depends chiefly on the property of sulphate of cobalt to resist a red heat, whilst the sulphates of iron and nickel are totally decomposed, may undoubtedly give good results, as applied to ores; but the author states that his researches in all other cases have failed to produce perfectly pure oxide of cobalt.

The author found that although sulphate of iron, when exposed alone to a red heat, is perfectly decomposed, yet, when mixed with a large quantity of sulphate of cobalt, it sustained it without being decomposed, and consequently without being rendered insoluble; the heat was very great, and kept up for several hours. If a mixture containing cobalt, but no arsenic, be treated according to M. Liebig's process, the iron, not being converted into an insoluble arseniate, remains in the mass partly in the state of sulphate. This takes place with zaffre, an arsenical ore of cobalt which has been roasted, and from which the arsenic has consequently been expelled. It results from what is above stated that the sulphate of iron formed partially resists the action of the heat, and consequently that the cobalt eventually obtained contains iron, though completely free from nickel.

Although processes are already known by which cobalt and iron are separated without much difficulty, the author states that one which he has discovered is so simple, and its employment so certain, that he thinks in making it known he may render service to the arts which include the use of pure oxide of cobalt.

This process depends on the difference which exists between the affinities of oxide of cobalt on one hand, and on the other of the protoxide and sesquioxide of iron, for acids; a difference which is highly advantageous to the first of these compounds. Take a solution of sulphate of cobalt containing a certain quantity of sulphate of iron, and add to this gelatinous hydrate of cobalt at least equivalent to the oxide of iron contained in the sulphate; heat the mixture to ebullition for some time; the violet colour of the hydrate of cobalt will soon disappear, and it will be replaced by a precipitate of a dirty yellow colour. In this case the hydrate of cobalt decomposes the sulphate of iron, is substituted for the proto or sesqui oxide of iron, which it renders insoluble, and precipitates in the state of hydrated sesquioxide; this hydrate is necessarily mixed with a small quantity of hydrate of cobalt, which should be used in excess, in order to be certain of the complete precipitation of the oxide of iron. Nothing remains to be done but to filter and wash the precipitate. The salt of cobalt thus obtained yields no indication of the presence of iron to the most sensible reagents. It yields, accordingly, no precipitate whatever when, after having added hydrochlorate of ammonia to it, it is supersaturated with great excess of ammonia.

For the sake of greater simplicity, a solution of carbonate of soda may be employed instead of the hydrate of cobalt, and the mixture digested at a boiling heat for some time; in both cases the precipitate will contain all the iron.

To recapitulate: it follows that in order to purify oxide of cobalt it is sufficient to dissolve it in dilute sulphuric acid, to evaporate to dryness, and calcine at a red heat, treating the mass with boiling water, and adding to the solution either hydrate of cobalt or carbonate of soda in the manner described. Sulphate of nickel appears to decompose more readily than sulphate of iron, under the circumstances described; when zaffre is treated according to M. Liebig's process, it yields oxide of cobalt quite free from nickel, but contains a large quantity of oxide of iron.—*L'Institut*, Juin 27, 1849, and *Phil. Mag.*

ON ALUMINATE OF COBALT.

By M. LOUYET.

M. Louyet remarks it as well known that alumina and the salts of cobalt may combine in certain circumstances, and form a fine blue colour. It is by this process that M. Thenard prepared the blue which bears his name, by mixing certain proportions of alumina and phosphate or arseniate of cobalt, and subjecting the mixture to a long-continued calcination. All these substances are employed in the gelatinous or hydrated state. As the precipitate formed by carbonate of soda in a mixture of alum and a salt of cobalt also yields a blue compound by calcination, it has been inferred that the constituent elements of cobalt-blue were alumina and oxide of cobalt, so combined that the compound may be considered as a salt, or an aluminate of cobalt.

The facts which M. Louyet has ascertained are, that the substance obtained by the mixture of gelatinous alumina and phosphate or arseniate of cobalt, also in the gelatinous state, yields a blue when subjected to a red heat. At this temperature the mixture of gelatinous alumina and hydrated oxide of cobalt yields only blacks or greys, whatever may be the proportions of the constituents. In order that the alumina and cobalt may produce blue, the mixture must be exposed to a temperature very near that of melting glass. It results from this that the presence of certain fixed acids is favourable to the combination of alumina with oxide of cobalt. These observations explain the cause of failure which chemists occasionally incur in attempting to prepare Thenard's blue without employing phosphate or arseniate of cobalt.—*L'Institut*, Juin 27, 1849.

ON THE PRESERVATION OF WATER.

By M. PERINET.

M. Perinet, ex-professor of the Hôpital Militaire d'Instruction, has succeeded in preserving water in a sweet state by placing a kilogramme and a half of black oxide of manganese in each cask of water containing 250 litres. He has kept

this water for seven years in the same barrels, and exposed them to various temperatures; at the end of that time he found it as limpid, free from smell, and of as good a quality as at the beginning of the experiment.

ACTION OF WATER ON LEADEN SERVICE-PIPES.

By E. N. HORSFORD,
Professor of Chemistry in the University of Cambridge, U.S.

The following extracts are taken from a very important investigation published in "The Proceedings of the Ameriean Academy of Arts and Seiences," for a copy of whieh we are indebted to the kindness of the author. The researehes were undertaken at the request of the Board of Consulting Physicians of the eity of Boston, and extend to fifty pages of elosely-printed letter-press. We give the author's conclusions, which have more than a local interest, and the method which he proposes for determining small quantities of lead, whieh promises to be of considerable serviee in such investigations:—

The waters used by man in the various forms of beverage and for eulinary purposes are of two classes. viz.

1. Open waters, derived from rain-falls and surfaee-drainage, like ponds, lakes, rivers, and some springs; and

2. Waters concealed from sunlight, and supplied by lixiviation through soils or roek, or both, of greater or less depth, such as wells and certain springs.*

They differ, (*a.*) in temperature; well water, through a large part of the year, is colder than lake, pond, or river water; (*b.*) in the per centage of gases in solution; recently-drawn well water, in summer particularly, parts with a quantity of air upon exposure to the surfaee temperature. In winter these relationshipe must to some extent be inverted, in high latitudes for a longer and in low latitudes for a shorter period.

(*c.*) They differ in the per eentage of inorganic matter in solution; well waters contain more; (*d.*) in the relative proportions of salts in solution; well waters contain more nitrates and ehlorides; and (*e.*) in the per centage of organic matter; well waters contain less.

Relations of Lead to Air and Water.—(*a.*) Lead is not oxidated in dry air, or (*b.*) in pure water deprived of air. (*c.*) It is oxidated in water, other things being equal, in general proportion to the amount of uncombined oxygen in solution. (*d.*) When present in sufficient quantity, nitrates in neutral waters are to some extent redueed by lead. (*e.*) Both nitrates and chlorides promote the solution of some coats formed on lead.

(*f.*) Organic matter influences the action of water upon lead. If insoluble, it impairs the action by facilitating the escape of air; if soluble, by consuming the oxygen in solution, and by redueing the nitrates when present. The green plants, so called, and animaleula which evolve oxygen, are abundant in open waters in warm weather only, and of course when the capacity of water to retain air in solution is lowest; so that, although oxygen is produced in open waters by these microseopic organisms, it does not inerease the vigour of their action upon lead.

(*g.*) Hydrated peroxide of iron (iron rust) in water is not reduced by lead. Hence may be inferred the freedom from eorrosion of leaden pipes eonneeted with iron mains, so far as the reduction of the pulverulent peroxide of iron may influenee it.

(*h.*) Alkaline chlorides in natural waters deprived of air do not corrode lead. (*i.*) Salts generally impair the action of waters upon lead, by lessening their solvent power for air, and by lessening their solvent power for other salts.

A coat of greater or less permeability forms in all natural waters to whieh lead is exposed. The first coat (*j.*) is a simple suboxide absolutely insoluble in water and solutions of salts generally. This becomes converted in some waters into a higher oxide, and this higher oxide, uniting with water and earbonic acid, forms a coat (*k.*) soluble in from 7,000 to 10,000 times its weight of pure water. The above oxide unites with sulphuric and other aeids, which sometimes enter into the constitution of the eoat (*k.*); uniting with organie matter and iron rust, it forms another coat (*l.*), which is in the highest degree protective. The perfection of this eoat and of the first above mentioned may be inferred from the small quantity of lead found in Croton water (New York) after an exposure in pipes of from twelve to thirty-six hours, and from the absenee of an appreeiable quantity in Fairmount water (Philadelphia) after an exposure of thirty-six hours when coneentrated to $\frac{1}{200}$ ths of its bulk.

Method of Determining Small Quantities of Lead. The recognition and quantitative determination of very minute quantities are not always without difficulty; where many and rapid determinations are required, the proeesses of gathering upon a filter, washing, drying, igniting, and weighing consume far too much time, and are sometimes less accurate than other and more indirect methods.

That which I have employed is based upon the mode of analyzing silver coin proposed by Gay-Lussac, and generally adopted at mints. The same general method has been extended by Gay-Lussac to aseertain the strength of alkalis and bleaching powder. It is employed with proto-sulphate of iron and subchloride of mercury for the latter purpose. It is the method of graduated solutions.

A gramme of lead in the form of the acetate (common sugar of lead), whieh eontains 3 atoms of water, is dissolved in 100 grms. or parts of distilled water. This constitutes solution No.1.

10 parts of this solution are diluted with 90 parts of water to make solution No. 2.

10 parts of solution No. 2, diluted with 90 parts of water, make solution No 3.

In the same manner solutions No. 4, No. 5, and No. 6 are prepared.

10 parts of eaeh solution are placed in corresponding test-tubes (about six inches long, five eighths of an ineh wide, and elosed at one end), and hydrosulphuric acid transmitted through them, till the liquid, first blaekened by the formation of sulphuret of lead, becomes elear.

Test-tube No. 1 contains one tenth of a gramme of lead in the form of sulphuret—a blaek powder at the bottom.

Test-tube No. 2 contains one hundredth of a gramme.

No. 3, one thousandth.

No. 4, one ten-thousandth.

No. 5, one hundred-thousandth.

No. 6 yielded no preeipitate without concentration.

Each succeeding preeipitate in the series, setting aside a slight allowanee to be made on aeeount of solubility, was one tenth as voluminous as the one above.

Having prepared this scale of quantities, it is required to determine the amount of lead in a given diluted solution. An experiment is made to ascertain if the quantity be large enough to give an immediate preeipitate with sulphuret of ammonium. This being deeided in the negative, 50 eubic centimetres or grammes of water (eorresponding with 50 parts of the scale of solutions) are carefully evaporated to dryness and ignited in a small porcelain capsule, to expel any organic matter that may have been present, moistened with nitric acid, and then warmed, with the addition of acetic acid and water, till the volume beeomes 10 eub. centim. A drop of aeetate of potash is then added, and then hydrosulphuric acid gas transmitted through the solution.

A preeipitate results, or it does not. If it does, to know its value or the amount of lead it contains, the scale is resorted to, Though it might rarely be possible to identify it with either one of two precipitates in the scale, there could be no difficulty in deciding between whieh two it should fall, or nearest to which one of the two it should be placed.

If 50 cub. centim. thus treated yielded no precipitate, 100 cub. centim. were evaporated to dryness, and the residue similarly treated. If this failed, 500 cub. eentim. were taken, and in some instances more, and the same course pursued.

It was natural to suppose that the presence of foreign bodies, such as oceur in natural waters, might embarrass the precipitation. This led to the preparation of a series of graduated solutions of lead, with all the eommon salts occurring in waters, from the reagents in my laboratory. They were similarly treated with acetate of potash, free aeetic acid, and a stream of hydrosulphuric acid; and, though it was possible to see differenees in the amounts of the precipitates, they fell very greatly within the differences between the successive members of the graduated series.

ON ANIMAL CHARCOAL AS AN ANTIDOTE.

By B. HOWARD RAND, M.D., of Philadelphia.

In the "Transactions of the Medical Society of London," new series, vol. i., is a paper by Dr. A. B. Garrod, detailing some experiments, in whieh he employed purified animal eharcoal as an antidote. This is prepared from ivory-black, by digesting it in dilute chlorohydric aeid to remove the earthy matters, afterwards washing and heating it to redness in a covered crueible. The subjects of his experiments were dogs, rabbits, and guinea-pigs. He administered large doses of opium, belladonna, aeonite, nux vomica, delphinium, stavesaere, white hellebore, and their alkaloids, as well as digitalis, hemlock, tobaeeo, elaterium, ipecaeuanha, hydroeyanic aeid, eantharides, and arsenious aeid, without injurious eonsequenees, when sufficient animal eharcoal was given simultaneously with them, or in some cases before the peculiar effeets of the drug were developed. It also prevented, but less eompletely, the action of the biehloride of mercury, and of the salts of copper and lead.

Dr. Garrod concludes from his experiments:—

1st. That animal eharcoal has the power of combining in the stomach with the poisonous principles of animal and vegetable substances, and that the compounds thus produced are innoxious; therefore, when given before these poisons have become absorbed, it will act as an antidote.

2d. That animal chareoal will absorb some mineral substances, and render them inert; but so large a quantity of the chareoal is required, that it is not so well adapted for many poisons of this class as their own special antidotes; the effects of arsenic, however, appear to be better combated by this than by any other article.

3d. That a eertain amount of animal charcoal is required, about half an ounce to eaeh grain of morphia, stryehnia, or any other alkaloid; but, of course, mueh less for the substanees from which they are obtained, as opium, nux vomica, &e., a scruple of nux vomica not requiring more than half an ounce of eharcoal.

4th. That the antidote itself exerts no injurious aetion on the body.

The method of preparing pure animal charcoal from ivory-black, before mentioned, is tedious and wasteful, only ten per cent. being obtained, while the amount of acid used is eonsiderable. A very good and pure chareoal is obtained by calcining leather scraps or blood with pearlash, washing and reheating in a elose crueible: it was this kind of charcoal which was principally used in the experiments to be detailed. Mueh of the discrepancy of experimenters with this substance is undoubtedly due to their use of an impure specimen of it.

With a view of ascertaining more aecurately the value of the proposed antidote, the writer performed a number of experiments, from which

* Rain-water is to some extent employed as a beverage. It is more nearly allied to waters derived from surfaee-drainage.

the following are selected as having the most direct bearing upon the subject:—

1. One grain of pure morphia was swallowed with about an ounce of pure animal charcoal in warm water; no narcotic symptoms supervened, but there was some gastric irritation, which subsided in the course of the day.

2. One grain of sulphate of morphia was digested with pure animal charcoal until all bitterness was removed; the liquid, filtered off and swallowed, produced no effect.

3. Ten grains of extract of belladonna were swallowed with two drachms of the charcoal; there followed vertigo, dilated pupils, dimness of vision, exceeding dryness of the throat, and desire to sleep, all of which symptoms were relieved by the spontaneous vomiting of a very acid matter, and the use of stimuli. The pupil remained dilated through part of the next day.

4. The last experiment was repeated, an antacid having been premised, and the proportion of charcoal being doubled. Some dryness of the throat followed, but with no other symptom of the influence of the drug.

5. Fifteen grains of powdered digitalis were taken, with three drachms of the animal charcoal, without the slightest disturbance of the functions.

6. Twelve drops of the officinal hydrocyanic acid were swallowed, with two drachms of the pure charcoal, without a sedative result.

7. One grain of strychnia, dissolved by the aid of a drop of chlorohydric acid, was digested with animal charcoal until all bitterness was removed. The solution, filtered and swallowed, produced no effect; a similar solution, evaporated and tested with nitric acid, gave no red tinge.

8. One grain of strychnia was swallowed, with an ounce of pure animal charcoal; no effects due to the strychnia could be perceived.

9. The purgative extracts were next tried, but produced no effect when sufficient animal charcoal was taken.

10. Camphor and musk were removed by animal charcoal from their tinctures, so far that they did not precipitate on the addition of water.

11. Phosphorus was removed from its ethereal solution by the charcoal.

12. Iodine was so far removed from its tinctures and compound solution as not to strike a blue colour with starch; and the iodine could not be liberated from the animal charcoal at a red heat.

13. Arsenious acid and a solution of arsenite of potassa were apparently unaffected, either in the hot or cold solution, by animal charcoal. This result, although it agrees with those of MM. Wapen and Graham, does not with the observations of Dr. Garrod, who states that animal charcoal "has greater power of removing arsenic from its solution than the hydrated sesquioxide of iron."

14. A solution of the bichloride of mercury being treated with animal charcoal gave, on filtration, no precipitate with ammonia.

In conclusion, we are perhaps justified in drawing, from the present state of our knowledge on this subject, the following conclusions:—

1st. That animal charcoal has the power of withdrawing, when used at a proper temperature and in sufficient quantity, most, if not all, known vegetable and animal poisonous principles, and certain mineral poisons, from their solutions.

2d. That, given at the same time with or shortly after these poisons have been swallowed, it prevents their deleterious action.

3d. That, given in cases of poisoning, it can exert no injurious influence, but, on the other hand, promotes vomiting, entangles the poison, and protects the coats of the stomach against it.

4th. That although it cannot be substituted for the usual antidote in poisoning by mineral substances, yet it may be usefully employed in conjunction with them, or in their absence.—*Medical Examiner* and *Edinburgh Monthly Journal.*

John Shaw, of Glossop, musical instrument-maker, for certain improvements in air-guns. Patent dated August 1st, 1849; six months.

THE CHEMICAL TIMES.

SATURDAY, AUGUST 11, 1849.

THE VENTILATION OF SEWERS.

The commissioners of sewers assert that they have received only two plans for draining the metropolis, viz., one by Mr. Phillips, the other by Mr. Austin. In our number of the 14th ult. we commented on the somewhat cavalier manner in which Mr. Coxworthy had been treated by the commissioners in reference to the plans which he submitted to their consideration in August last, under the strong recommendation of two parish meetings. The utter silence which the commissioners maintain regarding Mr. Coxworthy's propositions for purifying both the atmosphere and the Thames is perfectly unaccountable, the more so as Mr. Lovick, the officer appointed by the commissioners to attend the Christchurch meeting, a few days after that meeting, by letter dated 1, Greek-street, Soho, August 26, 1848, stated to Mr. Coxworthy that he should esteem it a favour if he would oblige him with a tracing of the drawings exhibited at the meeting; and Mr. Hertslet, the secretary to the commissioners, informed Mr. Coxworthy, in a letter dated November 14, 1848, in reference to the plans sent by him to Mr. Lovick, that his, with many others, *had been referred to the surveyors*, but *that the commissioners had not yet come to any conclusion upon the subject.* It is true that towards the close of last year Mr. Coxworthy addressed the Board of Health, the members of which are equally members of the sewers commission; seeking at their hands an inquiry into certain new principles in philosophy which strike at the very root of all existing doctrines in science;* and that they cannot well acknowledge the receipt of his plans without at the same time taking into consideration the principles on which these plans are laid—a task, possibly, to the discharge of which they may not feel themselves equal.

But the incompetence of the members of the board to deal with questions of the kind can surely not be pleaded as an excuse for the absolute refusal of inquiry on their part, with which Mr. Coxworthy's repeated applications have been finally dismissed by them. If they are not competent for the task imposed on them they should relinquish their offices, or, at all events, they should seek the assistance of those who are; nor would it have been at all difficult to subject Mr. Coxworthy's principles to the searching ordeal of experiment and practical application, which he solicited, and which, with the appliances Government have at their command, certainly need not have cost fifty pounds, and might, perchance, have required only an outlay hardly exceeding ten pounds. *En passant*, we may be permitted to observe that it strikes us as a rather curious fact that, whilst the gentlemen who constitute the Board of Health and the Sewers Commission have, in the former capacity, pronounced the quarantine laws to be useless as a preventive against epidemic complaints, on the ground that, when the nuisances and malaria that now pollute the atmosphere of towns shall have been got rid of, contagion will, so to say, be deprived of its fangs, the same gentlemen should in the latter capacity adopt the very means to pollute the atmosphere to the greatest possible extent.

The Registrar-General, in his report for the week ending the 28th ult., observes, in reference to cholera, that "the districts on the south side of the river still form the field on which the disease is most active. The deaths from it, which in this region were in three previous weeks 93, 192, 443, rose last week to 514. There is a slight decrease in the eastern districts. In the western and northern, comprising Kensington, Chelsea, St. George (Hanover-square), Westminster, St. Martin-in-the-Fields, St. James, Marylebone, Pancras, Islington, Hackney, and Hampstead, the deaths were only 68 against 53 in the preceding week. The districts which show the greatest mortality are Bermondsey, where 64 deaths occurred last week, Newington, where there were 66, St. George (Southwark), where there were 70, and Lambeth, where there were 111."

The whole of the country to the south of the Thames is nearly flat, so that in the sewers very little fall can be obtained; and we know that they discharge only at half and lower tides. In the sewers, then, the soil must naturally accumulate, and from thence it can be removed properly only by manual labour. But the commissioners, in their wisdom, have thought proper to attempt in this extensive district the highly objectionable practice of flushing the sewers, which is equally resorted to in the City. The practice of flushing has for its professed object the cleansing of the sewers. Its application serves to force on towards the river (and this, let it be borne in mind, in an *undecomposed state*) the whole of the putrefying matter daily voided into the sewers, and which, in this metropolis, must considerably exceed a million pounds per day of the most loathsome description of animal excrements, besides urine, house slops, and other filth. Now, whilst the sewers on the north side of the Thames, which is high ground, are *really* cleansed at the expense of the river, of course, by this flushing sytem (and to carry out which the City commissioners have half drained the New River, impairing thus, obviously, the capability of that river to discharge its legitimate functions, viz., to afford a proper supply of water to the houses in that locality), the objectionable practice, on the other side, produces no other effect than to stir up the filth, and carry death and desolation wherever the deleterious products of decomposition make their escape.

We perfectly agree with the Board of Health in the opinion that quarantine-laws will no longer be required when the atmosphere of towns shall be purified of its present pollutions; and, whilst we are prepared to admit that much of the present mortality may be referable to the want of, or to imperfect, house drainage, we are equally satisfied that many lives would have been spared in the southern districts of the metropolis had the commissioners of sewers attended to the remonstrances made and re-

* Vide *Chemical Times*, page 1 of the present volume.

commendations offered to them last summer by the inhabitants of St. George's aud Christchurch parishes.

In our last number we designated Mr. Phillips's plan of drainage as "practicable." By this we mean simply to imply, however, that the plan is feasible as far as regards the construction of a tank capable of containing the water-closet soil of London, and of applying to it machiuery equal to pumping out the contents at a higher level. But Mr. Phillips has inadvertently overlooked the most important fact, that, to convey this soil into its receptacle, it would be necessary to coustruct a second set of sewers throughout London, and a second draiu to every house already supplied with one. We do not profess, as journalists, to be able to give an exact estimate of the cost of such an undertaking; but we are quite sure that ten millions of money would not defray the expense. Instead, therefore, of the rateable property being assessed 1d. in the pound for the next twenty years to carry out such a plan, it would have to be rated at 1s. 8d. in the pound—an insuperable barrier, we are convinced, to the scheme, to say nothing of the difficulty that would inevitably be met with in many streets of obtaining sufficient spacc for the construction of a second sewer, and the public inconvenience that must attend the unavoidable obstruction in the streets. This part of our subjèct we may, therefore, consider as disposed of, with this additional remark, that, although we can readily compreheud that Mr. Phillips should have overlooked such an item in the estimate, his mind being engaged in the details of the other parts of his scheme, we certainly do uot think that it says much for the sagacity of his *especial* friends on the commission that they did not detect the oversight, although, of course, all the commissioners are highly qualified to pass judgment on whatever plans others may propose, no matter whether *with* or *without* a principle.

Of Mr. Austin's plan we have not sufficieut data on which to form an opinion; but, for the reasons we have above assigned, he cannot contemplate the separation of the house drainage from the land drainage. His main tank or tanks must, therefore, be of sufficient capacity at least to receive the fall of an average shower of rain on an area ten miles square, and the water supplied by the companies; and the sumps or sunks attached to such tanks must be provided with engines equal to pumping out and forcing into the country this enormous amount of matter; not omitting, of course, pipes of sufficient capacity to conduct it there; and these pipes must be sufficiently long to convey the water *where it will not be objectionable to the neighbourhood.* And here again tanks must be provided of sufficient capacity to contain and store up the valuable liquid until fetched away by the farmer. When Mr. Austin shall have laid down on plan and estimate all these details, he will have ample evidence to convince him that the £260 voted by the commission for boring London might be applied to a much better purpose, although that sum may be but a small fraction added to the extravagant waste that has already taken place.

It was long since suggested that the Thames might be relieved of the filth of Londou by constructing on both sides of the river immense conduits, into which the sewers should discharge, the upper part of such conduits being appropriated to the recreation of the population as an esplanade; but, to say nothing of the ruinous expense which such an undertaking must entail and the time necessary to its completion, there are, we suspect, also difficulties in the way which must render such a scheme wholly impracticable.

The filth to be got rid of must be discharged considerably below Gravesend, otherwise it must be brought back by the tide; and, as the sewers of the flat districts of Londou discharge only at half tides, it is obvious that to carry off the water these main dischargers must be sufficiently wide to admit of its free escape below that level, thereby rendering necessary an amount of encroachment on the river that other circumstances will not admit of; besides which, the excessively small amount of fall that could be obtained must naturally cause a constant accumulation of filth that would be in no way under control. The evil is one of a gigantic character that can be dealt with only by natural means.

Mr. Coxworthy argues, 1, that the natural receptacles for the drainage of the land are the rivers, which in all cases should be sufficiently capacious readily to couvey to the sea the rain that falls on the land, and, if not sufficiently deep or capacious to effect this object, should be made so—a proposition that has long since been made to his lordship, the Earl of Carlisle, by a civil engineer; 2, that the land draiuage and house drainage of towns must necessarily be the same, since the houses cover the greater portiou of the ground, and the remaining portion is being constantly traversed by animals that discharge on it vast quantities of offensive matter; and, 3, that accordingly the whole of the water should pass into one and the same receptacle, viz., the sewer, between which and the air in which the animal kingdom moves there shall be, chemically, no connection. His plans for effecting this object we have already described; they must be regarded as a great stride in the application of recent discoveries in science to the wants of society.

In order to bring the evil within more easy control, he proposes to subdivide it as much as possible, and then to apply the practice which has long been in use of causing the filthy water to flow slowly through dams or chambers, in order that the matter held in suspension may be precipitated; these dams being constructed in *the discharging sewers* either by building cross walls in them, or by sinking pits, according as the locality may render desirable, and the water being turned from one set of chambers into another set as they alternately require emptying.

We know, of course, that this proposition, diametrically opposed as it is to the plans submitted by others, and in which, *en passant*, no provision is made for ventilation, will meet with no great favour at the hands of either of the rival factions in the commission; yet no one will venture to deny that, if it be adopted, whatever amount of offensive gases may be generated in the sewers, none of the noxious effluvia will be able to reach our respiratory organs. Mr. Coxworthy proposes, moreover, to mix the matter collected in the sewer dams, previous to its removal, with a suitable proportion of peat charcoal or lime, which will serve both to deodorize and solidify it, and, besides, will add to the high fertilizing properties sewer manure is known to possess. We must defer the further consideration of this important subject till our next number.

On the Chemical Nature of the Egg.—M. Barreswil has presented to the Academy of Sciences a memoir in which he states that he has found sugar in the albumen of the egg, and that the albumen is alkaline owing to the presence of carbonate of soda. He finds also that the yolk contains little or no alkali, and that its emulsive property is derived from a product resembling the pancreatic juice, which is not acid, and becomes so only by undergoing alteration. He further states that the acid reaction and properties of the gastric juice are owing to organic acid, and not to hydrochloric acid.—*L'Institut*, Juin 20, 1849.

THE HEALTH OF THE METROPOLIS.

[From the Registrar's-General's Return.]

It is unsatisfactory to observe that the constant increase of mortality, which commenced in the second week of July, was maintained in the week ending Saturday last. The deaths from all diseases in last week were 1,967—a mortality nearly double the weekly average of the season, which is 1,008. The progress of the total mortality is shown by the following numbers returned in the last four weeks:—1,369, 1,741, 1,931, and 1,967. The deaths from cholera, which in six previous weeks were 49, 124, 152, 339, 678, 783, increased in the last to 926. A feature worthy of notice in the present return is the fact that, while the mortality caused by cholera has increased, there has been simultaneously a decrease in the deaths attributed to diarrhœa; for whereas the deaths from this disease (including dysentery) were in four previous weeks 54, 100, 146, 238, in the last week they declined to 198, an amount which is nearly the same as in the corresponding week of the summer of 1846, and little more than that of the same week of 1848. It is shown, therefore, that the total mortality from diarrhœa, dysentery, and cholera amounts in this return to 1,124, while the average is only 92. Consequently the excess from the three epidemics exceeds in some degree the increase above the average of the mortality from all causes, which is owing partly to the circumstance that the death from fractures, burns, and other injury registered in the week were unusually few. Other epidemics besides those mentioned are under the average, with the exception of hooping-cough, which a little exceeds it. The mortality from cholera still predominates on the south side of the river: the deaths there, which in the preceding week were 514, rose in the last to 621. On the north side of the Thames the deaths in the western districts were 58, showing an increase; in the northern 27, or nearly the same as in the former week; in the eastern 127, a slight increase; and in the central, which include St. Giles and St. George, Strand, Holborn, Clerkenwell, St. Luke, East London, West London, and City, there is a small decrease, the number being 93, though in the previous return there were .97 deaths. The greatest number in any district on the north side of the river is in West London, namely, 32. Of the southern districts, there were 67 in Bermondsey, 86 in Newington, 112 in St. George, Southwark, and 143 in Lambeth. The deaths in Rotherhithe are now comparatively few. The death of a man of 40 years in Brompton was caused by erysipelas of both legs, of putrid character (after five days' illness), caught from sleeping with a child who suffered from the disease.

The daily mean of the barometer was highest on Thursday, when it was 29.965. The mean of the week was 29.793. The temperature was under the average of the corresponding days of seven years on every day except Thursday. The highest in the shade was on Thursday, namely, 74°.5. The mean temperature of the week was 59°.5.

The following is the return of cases of cholera reported to the General Board of Health from the 13th day of July to the 6th of August, 1849, both inclusive :—

	Attacks.	Deaths.
In London and vicinity, viz. :—		
Lambeth	1,160	484
Bermondsey	630	102
Southwark	316	169
Newington Butts	337	195
Camberwell	173	124
Whitechapel	166	52
Poplar	138	26
Stepney	94	35
Limehouse	51	15
St. George's-in-the-East	65	21
Shadwell	46	9
Wapping	37	13
Radcliff	20	6
Spitalfields	26	8
Holborn Union	91	34
St. Giles's	40	19
Rotherhithe	38	34
Deptford	98	22
Greenwich	104	38
Lewisham	25	19
Other localities in London.	1,313	637
Total	4,968	2,062
In England and Wales, viz. :—		
Liverpool	1,970	694
Merthyr Tydfil	405	169
Dowlais	650	279
Gloucester	47	24
Cardiff	59	38
Salisbury	81	78
Nantwich	126	69
Portsmouth	115	73
Portsea Island	443	259
Plymouth	484	164
Mevagissey	87	41
Bristol	176	97
Taibach	65	36
Aberavon	45	23
Cwmavon	29	11
Clifton Union	82	47
Brighton	43	27
Poole	23	6
Other towns in England and Wales	1,901	870
Totals	6,831	3,005
In Scotland, viz. :—		
Dundee	532	264
Other towns in Scotland	42	27
	574	291
General Total	12,373	5,358

A Word to Butchers and Salesmen.—Some persons imagine that, as no bill was brought in last session, Smithfield Market will not be removed. The report of the committee determining the removal was made too late to afford time for the recommendation to be carried out. Notice was given on the last day of the session that the attention of the House will be called to the subject as soon as Parliament meets next session; and there is not the slightest doubt that the metropolis will be speedily rid of the nuisance, and the graziers relieved from the loss sustained by being compelled to submit their animals to the ordeal they go through in Smithfield Market. If the salesmen and butchers acted wisely they would at once remove themselves to Islington, where they can transact their business with as much freedom and greater convenience and comfort than in the present inadequate space to which they are confined.—*Mark-lane Express.*

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Conrad Haverkam Greenhow, of the city of London, engineer, for certain improvements in atmospheric railways. Patent dated January 13th, 1849. Enrolled July 13th, 1849.

This invention has reference to improvements in the atmospheric railway, patented by Messrs. Clark and Varley, and known as the resilient atmospheric traction-tube, by reason of its elasticity in opening at the longitudinal slit, to permit the passage of the coulter, and again to close by its own powers of contraction.

The first improvement consists in suspending the traction-tube, instead of having it bedded firmly on sleepers, as usual. For this purpose the patentee employs thin strips or sheets of metal about one eighth of an inch thick, which are rivetted to the tube, and extend round it till within about twenty-five degrees of the vertex, or on each side of the slit, where they terminate. The ends of these metal bands, which are placed at about six feet apart throughout the length of the pipe, are fixed to metal bars rising on each side of the pipe, and curved at the top so as to take the form of the pipe. Two risers, one on either side, being formed of one bar of iron, bent of a suitable form, if placed close round the tube, add to its resiliency. The horizontal part of the bar connecting the two risers is bolted down to sleepers laid in the ballast; a tube thus suspended has great freedom of action with regard to its expanding and contracting, during the opening of the longitudinal slit.

The second part relates to the means employed for opening the slit to permit the passage of the coulter; this is effected by four wheels, having vertical axes secured to a horizontal plate, so that the periphery of the wheels shall be level with the central horizontal line of the tube. These wheels are of rather less diameter than the internal diameter of the tube; but their axes are so disposed with regard to each other that the peripheries of two of their number are at a distance from the centre of the metal plate, greater than the same diameter of the tube, while the other two are at a similar distance on the opposite side; the distance from outside to outside of these wheels being about half an inch greater than the diameter of the tube, which, at the central horizontal line, has the effect of opening the slit about an inch. The coulter is formed of a plate of iron, about three eighths of an inch thick, and is attached to the plate that carries the opening wheels, and also to a long plate-iron tube, passing forward to the travelling piston, which forms its principal connection with the coulter. This tube is employed as a channel for the passage of air to the exhaust side of the piston, by opening a valve therein, in the event of its being necessary to retard the speed of the train; the valve-spindle, or other means of actuating the same, passing out at the opened part of the slit, to the advance carriage of a train, and to which the coulter is fixed. The coulter, as before mentioned, consists of a plate of metal of three eighths of an inch thick; and is attached to the wheel plate and tube inside the traction-tube, and extended to nearly the whole length of the traction-carriage; after it emerges from the slit, it is connected to the carriage at each end, by means of two short chains, each having a wedge-piece connected to it by the small end. The two wedge-pieces are passed upwards, through a bar or plate in the bottom of the carriage, the opening being tapered with the small end downwards; so that by introducing a wedge from above, between the two passed from below, they are securely held therein. The connection is effected in a similar manner at both ends of the coulter. The wedges introduced from above, as the holding wedges, are attached to levers, so that they can be readily and immediately caused to fix to, or release the carriage from, the coulter.

The third improvement consists in a method of preventing any injury to the sides of the slit from abrasion, by reason of the coulter touching the sides; this is effected by fixing a rigid rail or plate, standing up from the tube on one side of the slit. A wheel or wheels, of which the spindles or axes are fixed to the coulter, traverse on the top of this rail, and the periphery of the wheel having a groove accurately fitting the top of the rail sideways, by which any swerving of the coulter is entirely prevented; and, consequently, no abrasion or damage can result to the closing surfaces of the traction-tube.

The fourth improvement refers to what is termed an exit-valve in the traction-tube: it consists of a circular valve, placed in an enlarged portion of the tube; the enlarged part being of such a diameter as to admit of a horizontal spindle, on which the circular valve is suspended, being below the bottom of the traction-tube. This valve, as before mentioned, consists of a disc or plate, having a groove in its periphery, in which is placed an inflated tube of flexible material, so that, on the valve or disc taking a vertical position, it shall fit closely round the tube, at its enlarged part. By the spindle on which this valve is suspended being in a central position in the direction of its horizontal diameter, the pressure of the vacuum is equal on both sides; so that very slight pressure is sufficient to move it in a horizontal position, and allow the piston to pass. The piston is furnished with a spring bow or hoop, which precedes the piston, and comes in contact with a spring on the side of the valve, immediately throwing it in a position to admit the passing of the piston. The valve-spindle is connected with a spring, so as to cause the valve to resume its closed or vertical position after the passage of the piston; and this in whichever way the piston may pass.

The sixth and last part has reference to a method of producing a vacuum in suitable condensers by which to exhaust the traction-tube. For this purpose the patentee employs two vessels, the lower parts of which are of a cylindrical form, and set in solid masonry sunk in the ground; while the upper part of each is of a spherical form, and suitably stayed in the interior to render it of such strength as to be capable of resisting vacuum pressure. These vessels or condensers are intended to serve as a kind of reservoir for the exhaustion of the tube. Each condenser should be of a cubical content, equal to the entire length of the traction-tube to be exausted; so that the vacuum having been produced therein previous to the starting of a train, it is simply necessary to form a communication between the traction-tube and one of these vessels by opening a valve in the connecting-tube; which is so arranged that one pipe from the tube branches off by a T piece to both vessels, each having separate valves, by which the communication may be separately or jointly effected, and both acting simultaneously in the exhausting the tube. The top of each vessel is fitted with a cover, which can be readily opened and shut in such a manner as to render it air-tight; this arrangement being for the purpose of introducing water therein when the vessel is full of air. It is necessary to have a good supply at command, as the intention is to fill the vessels each time the vacuum is destroyed by the admission of air from the traction-tube. When either vessel is full of water the cover is shut, and the water allowed to run off by a pipe from the lower part of the vessel, which pipe must have a perpendicular fall of thirty-four feet, in order that the barometric level of thirty-two feet sustained in the pipe may produce the vacuum desired. The patentee's claims in the atmospheric system of railway propulsion, known as Clark and Varley's, are:—

First. The suspension of the tube in atmospheric railways by straps, in the manner described.

Secondly. The employment of a horizontal wheel within, and of greater diameter than the traction-tube, in order to widen the horizontal

slit for the passage of the coulter as described.

Thirdly. The employment of the grooved wheel and rigid rail to prevent the swerving of the coulter.

Fourthly. The modes of attaching the coulter to the piston and the leading carriage, each as described.

Fifthly. The employment of an exit-valve, constructed as described.

Sixthly. The obtaining a vacuum by causing water to fall from an air-tight vessel or vessels to its barometrical level.

John Mitchell, chemist, Henry Alderson, civil engineer, and Thomas Warriner Farmer, of Lyon's Wharf, Upper Fore-street, Lambeth, for improvements in smelting copper. Patent dated December 28th, 1849. Enrolled June 28th, 1849.

This invention is applicable to the following ores:—

1st. Ores containing sulphuret of copper. 2d. Ores containing sulphuret of copper together with some other metallic sulphuret or sulphurets. 3d. Sulphuret of copper with sulphate of copper. 4th. Sulphuret of copper with other metallic sulphurets and sulphate of copper. 5th. Carbonate or oxide of copper. 6th. Carbonate or oxide of copper with one or several of the sulphurets or other metals. 7th. Carbonate or oxide of copper together with the sulphuret of copper. 8th. Carbonate or oxide of copper with sulphuret of copper and other metallic sulphurets. 9th. Sulphate of copper combined with either of the 7th or 8th.

In treating ores according to this invention, the patentee divides the ores above mentioned into two classes, viz., 1st, those free from the sulphates of lime, baryta, strontia, or magnesia; 2d, those containing either of these sulphates. Each of these classes are again divided by the patentee into two orders of ores, viz., those containing 25 per cent. of copper and upwards, and those containing less than 25 per cent. of copper.

Ores of the first class are (after being fine-dressed) roasted in a roasting-furnace, the heat being gradually raised, and the ore raked all the time, so as to expose all parts alike to the heated air, that the sulphur may be all oxidized. After the ore has been exposed to the fire for some time, the heat must be increased as much as possible without causing the mass to agglutinate. In half an hour a sample may be drawn, and tested for sulphate of cooper; and, should any appear still to exist, the heat must be continued till only a trace can be detected; the charge is then ready for the refining process.

In treating ores of the second class, the patentee says that in practice the sulphates of lime, baryta, or strontia are of no consequence, or scarcely interfere with his process; but, should the ore contain magnesia, it is to be fine-dressed and roasted as above, and then thrown into a tank or cistern with a false bottom, and there left covered with water for four hours, stirring it occasionally. The water, which will dissolve out all the sulphate of magnesia, is then to be drawn off, and the ore is ready for the refining process, if it belong to the first order.

Ores of the second order are smelted so as to obtain a regulus of the required strength.

The refining process consists in mixing silica with the roasted ore, together with old slag and lime enough to cause it to flow freely. To ore containing 88 per cent. of copper, about 35 or 40 per cent. of sand, slag, and lime must be added, with about one tenth of its weight of carbonaceous matter. The whole (in powder) is well mixed, and smelted in the smelting-furnace; when fluid, a portion of the slag is withdrawn, and tested for copper; should it contain any, more carbon must be added, and well stirred in, and this must be repeated till the slag contains no more than a trace of copper.

The patentee does not claim any particular form of furnace, but he claims the process of separating sulphate of magnesia, as above described; and the use of silica in separating metallic copper without the aid of alkalis or oxide of iron.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING AUGUST 1ST, 1849.

John Holt, of Todmorden, Lancashire, manager of the Waterside Works, for improvements in machinery or apparatus for preparing cotton and other fibrous substances, parts of which improvements are applicable to machinery used in weighing. Patent dated July 24th, 1849; six months.

Alexander Ferrier Rose, of Greenvale-place, in the city of Glasgow, North Britain, gentleman, for a certain improvement or certain improvements in the process or operation of printing, and in the machinery or apparatus employed therein. Patent dated July 24th, 1849; six months.

Joseph Woods, of Barge-yard Chambers, Bucklersbury, civil engineer, for improvements in bleaching certain organic substances, and in the manufacture of certain products therefrom. Patent dated July 24th, 1849; six months.—(Communication.)

George Fellows Harrington, of Portsmouth, dentist, for improvements in the manufacture of artificial teeth, and the beds and palates for teeth. Patent dated August 1st, 1849; six months.

Florentin Joseph De Cavaillon, of Paris, chemist, for certain improvements in obtaining carbonated hydrogen gas, and in applying the products therefrom to various useful purposes. Patent dated August 1st, 1849; six months.

Eugene Alexandre Desire Boucher, of Rue des Vinnegaries, Paris, metal-merchant, for certain improvements in the manufacture of cards. Patent dated August 1st, 1849; six months.

Jerome Andre Drien, of Manchester, machinist, for certain improvements in the manufacture of wearing apparel, and in the machinery or apparatus connected therewith. Patent dated August 1st, 1849; six months.

Benjamin Thompson, of Newcastle-upon-Tyne, civil engineer, for improvements in the manufacture of iron. Patent dated August 1st, 1849; six months.

Thomas Potts, of Birmingham, Warwick, manufacturer, for improvements in apparatus used with curtains, blinds, maps, and plans. Patent dated August 1st, 1849; six months.

William Geeves, of Battle-bridge, saw-mill-proprietor, for improvements in the manufacture of boxes for matches, and other purposes. Patent dated August 1st, 1849; six months.

Julian Edward Disbrowe Rodgers, of High-street, Pimlico, Middlesex, professor of chemistry, for improvements in the manufacture of white lead. Patent dated August 1st, 1849; six months.

David Harcourt, of Birmingham, for improvements in vices, and in the manufacture of hinges; and also in apparatus for dressing and finishing articles made of metal. Patent dated August 1st, 1849; six months.

Adam Yule, of Dundee, master mariner, and John Chanter, of Lloyd's, gentleman, for improvements in the preparation of materials for coating ships and other vessels. Patent dated August 1st, 1849; six months.

Richard Kemsley Day, of Stratford, in the county of Essex, hydrofuse-manufacturer, for improvements in the manufacture of emery paper, emery cloth, and other scouring fabrics. Patent dated August 1st, 1849; six months.

Augustus Roelm, of Paris, in the Republic of France, gentleman, for improvements in making roads and ways; and in covering the floors of courtyards, buildings, and other similar places. Patent dated August 1st, 1849; six months.

James Murdoch, of Staple-inn, mechanical draughtsman, for certain improvements in converting sea water into fresh, and in ventilating ships and other vessels; applicable also to the evaporation of liquids, and to the concentration and crystallization of syrups and saline solutions. Patent dated August 1st, 1849; six months.—(Communication.)

John Parkinson, of Bury, in the county of Lancaster, brassfounder, for improvements in machinery or apparatus for measuring and registering the flow of liquids. Patent dated August 1st, 1849; six months.

INTERESTING DISCOVERY.—M. Paul Gervais (says the *Constitutionnel*) has just discovered in the upper tertiary stratum of Montpellier a species of fossil ape, probably belonging to the Macaque genus. On comparing this discovery with that of M. Lartet in the Gers, and those made in the environs of London, it appears that fossil apes have been discovered in the three principal tertiary strata of Western Europe, that is to say, in every part of the level of sedimentary earths in which the bones of mammalia abound. If man had existed at the period when these strata were deposited, the non-discovery hitherto of the slightest trace of human skeletons, or remains attesting human industry, would be very astounding. The discovery of these fossil apes is, therefore, an additional indirect proof of the very inferior antiquity of man on the earth.

TO CORRESPONDENTS.

"Alpha."—The frosted appearance of ground glass may be very nearly imitated by *gently* dabbing the glass over with a piece of glazier's putty stuck on the ends of the fingers. When applied with a *light* and *even* touch the resemblance is considerable. Another method is to dab the glass over with thin white paint, or flour paste, by means of a brush; but this is much inferior to the former.

"An Old Subscriber."—We know of no other process of purifying saltpetre except repeated recrystallization.

"A. B."—1. Take of cuttlefish bones, eight ounces; roach alum and orris-root, of each one ounce; cream of tartar, two ounces; oil of rhodium, six drops. Reduce the solid ingredients to a fine powder and mix. Or, take of bark and Armenian bole, of each one ounce; powdered cinnamon and bicarbonate of soda, of each half an ounce; oil of cinnamon, two or three drops. Reduce the solid ingredients to a fine powder, and mix. Charcoal, which is generally employed as a dentifrice, acts partly mechanically and partly by its chemical properties of destroying foul smells and arresting putrefaction. For this purpose it should be newly burnt, and kept in well-closed vessels, as by exposure to the air it rapidly loses its antiseptic powers. 2. Consult a surgeon-dentist.

"Observer."—The man is a fool. The woman died of cholera, and not of the chalk mixture.

"A Young Student."—Lithofellic acid was discovered by Göbel in a biliary concretion. It forms the chief portion of the substances called bezoar stones. Göbel obtained it by digesting the calculus in boiling alcohol of 98 Cent.; evaporating, and subsequently redigesting the residue first in cold and then in boiling alcohol; from the latter solution the acid was obtained by slow evaporation. Pure lithofellic acid is colourless and crystalline; it forms salts with the bases.

"A Patentee."—We cannot advise you in the matter. Address yourself to Mr. Carpmael.

"A Country Subscriber."—The office of the *Medical Times* is at 147, Strand.

"Mr. Macmillan, Glasgow."—We have received neither letter nor sample. There must be a mistake somewhere.

THE CHEMICAL TIMES is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentleman may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary or scientific communications to be addressed to the Editor, 320, Strand.

London: Printed by ROBERT PALMER, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London, and published by the said ROBERT PALMER, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—August 11, 1849.

ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXIX.

(LECTURE CII.)

VEGETO-ALKALIS—(*Continued*).

STRYCHNIA AND BRUCIA.

Strychnia and brucia have an analogous (perhaps identic) medicinal action.

In the St. Ignatius' bean strychnia is found almost free from admixture with brucia, which latter alkaloid, on the other hand, is found isolated in the spurious angustura. Strychnos nux vomica contains both alkaloids.

It is remarkable that the plants which contain these two alkaloids belong all to one and the same family, viz., that of the Strychneæ.

From the results of the analyses of nux vomica and the St. Ignatius' bean it appears that the seeds of the strychneæ owe their poisonous properties to the strychnia, or to that alkaloid and brucia conjointly.

Strychnia and brucia, when introduced into the animal economy, act most energetically upon the nervous system: violent shocks and spasms ensue, succeeded by tetanos, and finally terminating in death. The action which these alkaloids exercise upon the system affects chiefly the spinal marrow; hence tetanic contractions in the muscles of the extremities and chest, which contractions stop the movement of the respiratory apparatus, and cause thus finally the death of the animal.

The seeds of the strychneæ are contained in an acidulous pulpy fruit, of which several species are eaten, *e.g.*, the Strychnos innocua of Senegal; the Strychnos nux vomica and Strychnos spinosa of Madagascar; the Strychnos petatorum of the East Indies. The latter fruit, however, is said to act as an emetic when arrived at perfect ripeness; its seeds are said to be used for the purification of water.

The wood of the strychneæ also appears to contain strychnia. Pelletier and Caventou found this alkaloid in the wood of Strychnos colubrina. It is, no doubt, present also in the wooraly* or ourary of the Indians of the Orinoco, and in the Upas tieute or tshettik of the Javanese, which is the bark of the Strychnos tieute, and exercises on the animal economy a similar action to that of strychnia.

STRYCHNIA.

The formula of strychnia is, according to Liebig:—

$$C_{42}\,H_{22}\,N_2\,O_5.$$

Strychnia crystallizes in octahedrons or in minute four-sided prisms. The crystals are obtained by allowing a solution of the alkaloid in boiling alcohol to evaporate spontaneously.

The taste of strychnia is excessively bitter.

It is one of the most virulent and deadly poisons known to us.

It is neither fusible nor volatile.

It suffers decomposition at between 593.6 and 599 Fahr.

It contains no crystallization water.

It may be said to be nearly insoluble in water, requiring 6,687 parts of cold and 2,500 parts of boiling water for solution.

It is insoluble in anhydrous alcohol, and only very sparingly soluble in alcohol at 94 Cent. It is soluble, however, in common spirit of wine.

It is insoluble, or nearly so, in ether; it dissolves more readily in volatile oils; the fatty oils fail to dissolve it, or, at all events, dissolve only a very minute portion of it.

The action of strong nitric acid imparts a red tint to *impure* strychnia. No change of colour is observable in the *pure* alkaloid.

A mixture of strychnia with sulphur, when heated to the fusion point of the latter substance, undergoes decomposition, with disengagement of sulphuretted hydrogen gas.

If an infinitely small quantity of strychnia be triturated with a little peroxide of lead, and a drop of sulphuric acid containing 1 per cent. of nitric acid be let fall upon the mixture, a magnificent blue colour will instantly appear, which will quickly change to violet, then gradually to red, and finally, after a few hours, to canary-yellow.—(E. Marchand.)

Strychnia is one of the most basic vegeto-alkalis: it precipitates most of the organic alkaline bases. The salts have a bitter taste. Tannin precipitates them. Nitric acid colours them red if they happen to have been prepared from impure strychnia.

Oxalates and tartrates fail to precipitate the salts of strychnia.

Perchloride of gold precipitates them with a canary-yellow colour.

BRUCIA.

The formula of brucia is, according to Liebig:—

$$C_{44}\,H_{25}\,N_2\,O_7.$$

Its equivalent is 486.

Brucia crystallizes in oblique four-sided prisms with parallelogrammic basis.

From a saturated alcoholic solution it crystallizes in nacreous scales presenting the appearance of boracic acid.

Brucia has an exceedingly bitter and somewhat acrid taste, which persists a long time in the mouth.

It dissolves in 850 parts of cold, and 500 parts of boiling, water.

It combines with water. Its crystals are a hydrate; they contain 1 equiv. of brucia and 8 equivs. (=16 per cent.) of water, which they lose upon fusion.

The affinity of brucia for water is very remarkable. When precipitated from one of its solutions by potass or soda, it absorbs a considerable quantity of water, which it loses only on fusion. The purer the brucia the more water does it absorb under these circumstances.

The brucia which is obtained from nux vomica appears at first as a soft, yellow-coloured, pitchy mass. After having been kept for some time in water it hardens and becomes hydrated. Meanwhile the colouring matter dissolves in the water, which circumstance claims the more attention since the colouring matter is known to adhere pertinaciously to the brucia in its salts.—(Pelletier and Dumas.)

Heated to a temperature little above that of boiling water, brucia fuses, and the fused mass solidifies subsequently on cooling to a non-crystalline body resembling wax. When this mass is reduced to powder, and the latter mixed with water, it reabsorbs crystallization water in the course of a few days.

Brucia dissolves readily in alcohol.

Ether and the fatty oils fail to dissolve it.

It is sparingly soluble in the volatile oils.

Nitric acid imparts to it a deep blood-red colour, which changes subsequently to yellow. During this reaction a gas is disengaged which contains nitrous ether.

Perchloride of gold precipitates the salts of brucia with a light brownish-yellow colour (like milk coffee), which changes to a chocolate-brown.

The addition of protochloride of tin to the yellow fluid obtained by the action of nitric acid upon brucia imparts to it a pretty violet colour, and this change of colour is attended with the subsidence of a precipitate of the same tint. Strychnia yields under the same circumstances only a dirty precipitate.

The salts of brucia are excessively bitter.

Most of them are crystallizable.

They are decomposed by morphia and strychnia.

They differ from the salts of strychnia in this essential point, that after the addition of tartaric acid they are no longer precipitated by the alkalis.

The oxalate of brucia is insoluble in alcohol; and it was upon this property that the first method of extracting brucia was based.

The neutral nitrate of brucia is uncrystallizable.

* The juice of Strychnos toxifera.

ON THE AGE OF THE VOLCANOES OF AUVERGNE, AS DETERMINED BY THE REMAINS OF SUCCESSIVE GROUPS OF LAND ANIMALS.

By Sir C. LYELL, F.G.S., &c.

The scientific interest which attaches to the highland region in which the volcanoes of Auvergne are contained arises from the important fact that during the period in which its geological character was forming—whilst its structure, as well geographical as geological, and the animals and plants by which it is inhabited, were undergoing great change—the district was never once submerged beneath the sea. Generally speaking, the volcanic rocks of Europe have either been of submarine origin, or the surface, since they were produced, has suffered so much denudation by the action of the waves of the ocean as to make it impossible for us to determine the form and manner in which the eruptions took place, or the relative position held by the igneous formations to the then existing hills, plains, and valleys. Throughout the whole extent of the elevated region under consideration here there are frequent irregular alternations of different primitive rocks; upon considering the whole, these may be reduced to three principal divisions. The granite occupies the wide band between the Allier and the Rhone; a gneiss formation divides the Allier from the Seille (Saone?), and is continued in the mountains of Cezallier, La Marguerite, and part of the Lozere and Cevennes; lastly, the mica-schist formation covers and extends over the whole western scope. As it is impossible to assign precise limits to these formations—perfect granite often occurring in the districts of gneiss and mica-schist, and passes on into gneiss, being as common as that of granite—it will be sufficient to say generally, that felspar predominates along the eastern portion, that this element diminishes, and the proportion of mica increases through the middle, and that on the west mica prevails, to the almost total exclusion of felspar. Such is the primitive district of the centre of France, in which the volcanoes of Auvergne are situate. The volcanic formation of central France attains an elevation much superior to that of the highest visible point of the primitive plateau. The Mont Dor, the Cantal, and the Tuezen, each lifts its colossal form in the plateau around to the height of 6,000 feet in the two first, and 5,800 in the last instance. They have a common figure, gradually sloping on all sides, from some highest point to the table land which surrounds them, and their composition of volcanic beds bears internal proof of their having been once fluid, since the materials have followed the universal law of fluids in their descent, lying uniformly parallel to the sides of the mountain until they reach, and spread themselves out to some distance in, the plain below. The traces of their different craters have, it is true, been almost obliterated by the various agents of destruction by which they have been long and violently attacked, and which have swept away the looser products of their eruptions, and surround their flanks sometimes with deep and wide valleys. The volcanic rocks which enter into their composition are trachytes and basalts of various descriptions; but, perhaps, half of their mass is formed of the debris of these rocks of pumice and scoriæ, with occasional fragments of granite, united into a tufa or breccia, varying constantly in the size and qualities of the ingredients, its degree of induration, &c. Another series of mountains occur within the limits of a zone of no great breadth, commencing

near Abuttras to the south, and prolonged towards the north, through the range which divides the Loire from the Allier; continued along the base of Mont Dor, and terminating in the chain of Puys, which skirt the Limagne d'Auvergne to the west. These consist of basalt and its conglomerates, and also contain a few formations of trachytes; instead of uniting to form distinct and lofty mountain groups, they are very generally distributed over the whole portion of the primitive plateau. The eruptions which produced this class of rocks seem, in scarcely any instance, to have broken out in the same spot, but to have burst forth singly and successively in different though neighbouring points. Some of them exhibit features exactly similar to the remains of a modern eruption from Etna and Vesuvius, viz., a conical hill with a more or less circular basin or crater at the summit, evidently the result of accumulation about a volcanic aperture of loose scoriæ, projected from it by violent gaseous explosions. From the lowest lip of the crater, or sometimes from the foot of the cone, a current of lava is seen to have issued and flowed frequently to a distance of ten or twelve miles from its source, uniformly seeking the lowest level, penetrating valleys, filling up the bed of the streams, or spreading itself in all directions over a wide extent of plain, according to the nature of the ground it reached. The mountain streams, which were even driven from their channels by these fiery torrents, still continue to flow, and in most cases have worn out a fresh bed from the granite or calcareous rocks which bounded them originally. This new channel has usually been made along the line of junction of these rocks and the lava. In some places it is but a few feet in depth; in others the violence of the stream, or its long-continued action, has excavated an entire valley below the level of the former one, the thalweg of which, with its rocky load of lava, impends over it on one or both sides.

Before proceeding to the illustration of the age of the volcanoes of this region, I must describe the original mountain mass on which my illustration is located. The Puy de Dome occupies the centre of the chain of Puys, and in its proportions it leaves its neighbours far behind; its absolute height is 4,842 feet, and it rises 1,600 feet above the average level of the plateau around. Its figure is that of an irregular cone, very obtusely truncated, the upper surface sloping very considerably to the west. A rounded eminence on its eastern summit gives it, when viewed from that side, somewhat the appearance of a cupola. In consequence of the very different composition of its substance, which resists decomposition and atmospheric erasion much more in some parts than in others, two sides are, as well as the summit, covered with a thick grass, and present a smooth and gently curved outline, while those of the other are broken by rocky projections, giving them a still ruder character. The fissures of the harder portions of rock are lined both with laminar and octohedral crystals of iron; those of the more earthy with similar sublimations, but which in these points assume the brightest tints of blue and green, and occasionally with a coating of sulphur. The substance of the rock itself is in many places stained throughout with varying shades of an ochry yellow, a citron, a rose, a scarlet, and a greyish-blue colour. A chapel was anciently erected on the summit of the Puy de Dome, of materials brought from a distance, and the ruins of this building have probably strewed the sides of the mountain with the blocks of basalt which are occasionally found there. The type of one of the most modern cones of eruption in this region on which I shall dwell this evening is the Puy de Tartaret. Its comparative recent origin is proved by its standing at the bottom of a deep valley, excavated through the alternating beds of trachyte, pumice, and basalt, belonging to the more ancient volcano of Mont Dor, and partly through the subjacent and fundamental granite. It is further confirmed by the course of a powerful current of lava, which, proceeding from the base of the cone, flows thirteen miles down the channel of the river Creuse, stopping at the town of Nechers, near Issoire. The lava stops the ancient river bed, and is observed to contract in its dimensions in the gorge of the river, where, like the water of a river in passing through an arch, or forced back by the tide, it gains in height; and it expands again where the valley opens, spreading into a broad sheet having a level surface. It also flows up the channel of tributary streams, till it obtains a level corresponding with the top of the lava at the point of junction of the tributary with the main valley. But, although these appearances prove that the valley has flowed as it would do now if it were remelted and made again to descend the main channel, it nevertheless has, in some parts of its course, the marks of considerable age.

I beg to allude here to an attempt which has been recently made to frustrate the ends of geology, on the part of a writer in an influential work — "The Quarterly Review." The writer of the article alluded to endeavours to make it appear, from a passage in the writings of a bishop of the fifth century, that the volcanoes in question had a mediæval origin. He describes the phenomenon of volcanic eruption as contemporaneous with the irruption of the Goths. This bishop, whose testimony is made so much of, was Sidonius Apollinaris, Bishop of Clermont, consecrated 471, who resided on the borders of Lake Aidat, and his evidence is contained in a letter written to Mamertus, Bishop of Vienne. The latter prelate, whose people were alarmed by the impending invasion of the Goths, had assembled his people for humiliation and prayer, some fifteen years before, on account of certain prodigies. Earthquakes shook the mountains, thunder rolled through subterraneous caverns. So awful were the concussions, the sounds, the fires, that the beasts of the forest, terrified, forsook their haunts, and took refuge with mankind. Mamertus instituted solemn litanies or rogations on the three days preceding Ascension-day, and these supplications, soon adopted in Gaul and England, remain still in the calendar of the church. Well, Sidonius Appolinaris, writing to this Mamertus, uses language in relation to this phenomenon which by no means necessarily implies volcanic eruptions. He says:—"The walls of the city of Vienne were shaken by frequent earthquakes; many fires broke out, and mounds of ashes were heaped upon the fallen copings of the walls." Deer also took refuge in the Forum, and the people fled, all but the bishop, who had a right to reckon on divine protection, because, as Sidonius reminds him on a former occasion, the flames at his approach had miraculously receded out of reverence to his holy person. At the time of the earthquake Mamertus had told his people that their repentant tears would extinguish the fires sooner than rivers of water, and the steadfastness of their faith would cause the rocking of the ground to cease. Sidonius finishes by requesting Mamertus to send him some relics to make all safe. The style of the whole epistle is throughout so faulty, ambitious, and poetical, as to make it difficult to know the exact value of the expressions, and dangerous to found upon them any philosophical argument about natural events. There is not a word about Auvergne, but simply an allusion to the shocks which appear to have thrown down buildings, and caused, as usual in such cases, where roofs fall in, great conflagrations and heaps of cinders. The terror of wild animals when the earth rocks, and their sensitiveness of the slightest movements, are well known. Although the epistle proves the writer to have had a fair share of the credulity of his age, both in respect to miracles wrought in favour of a contemporary saint, and the efficacy of relics, it would be unfair to charge him with a belief in the occurrence of a volcanic eruption at or near the site of the city of Vienne, which the investigation of the ablest government surveyors, to whom the construction of a geological map of France has been entrusted, has entirely disproved. In fact, there are no monuments of volcanoes in Dauphiné; and, if there had been, their discovery would throw no light on the date of eruptions in Auvergne.

In the limestone basins of Auvergne, Cantal, and Velay, no volcanic pebbles have ever been detected, although massive piles of igenous rocks are found in the immediate neighbourhood.

[*To be continued.*]

ORIGINAL COMMUNICATIONS TRANSLATIONS, ETC.

ON XANTHOPROTEIC ACID.
By M. VAN DER PANT.

Xanthoproteic Acid from Albumen.—Coagulated albumen is reduced to a fine powder, and exposed for 168 hours to the action of a mixture of 2 parts water and 1 of commercial nitric acid. A great portion remains undissolved. Water is added, the sediment washed with water, the fat removed by ether, dried in the air, again redueed to a fine powder, and then dried at 266° F.

The acid dissolves entirely in ammonia, forming a dark brown liquid. If the ammoniaeal solution of the acid is evaporated to dryness in the water-bath it no longer redissolves so readily in water. To prepare the salts of copper, lead, and baryta, the xanthoprotcate of ammonia is evaported to the consistenee of a syrup, and then diluted with water. Xanthoproteic acid, prepared as above and dried at 266°, furnished on analysis:—

	I.	II.	III.	IV.	V.	
Carbon ..	50.48	50.45	50.16	49.91	50.25	50.50
Hydrogen	6.61	6.51	6.35	6.21	6.42	6.30
Nitrogen	15.28	14.77	14.90	14.57	14.84	15.15
Oxygen	26.47	27.11	27.43	28.15	25.29	
Sulphur	1.09	1.09	1.09	1.09	1.09	27.15
Ash	0.07	0.07	0.07	0.07	0.07	

I. to IV. were made with the acid as originally obtained, V. with the acid which had been dissolved in ammonia. The composition is the same, the ammonia being expelled at 266°. The colour, however, continues of a much darker colour, but this is produced by a mere trace of ammonia. The barytie compound yielded 13.11 per cent. baryta, and for the organic substance:—

	I.		II.	
Carbon	45.15	51.96	45.17	51.97
Hydrogen	5.40	6.22	5.34	6.18
Nitrogen	12.63	14.53	12.63	14.53
Oxygen	..	27.29	..	27.33
Sulphur				

The copper salt, obtained by preeipitating xanthoproteate of ammonia with acetate of copper, is a green precipitate, which after washing and drying furnishes a dark green salt. Dried at 266°, it gave on analysis 12.9 per eent. oxide of copper, and for the organic substance:—

	I.		II.	
Carbon	44.89	51.53	46.90	52.76
Hydrogen	5.80	6.65	5.73	6.40
Nitrogen	13.89	15.97	12.63	14.20
Oxygen	..	25.85	..	26.64
Sulphur				

Xanthoproteic Acid from Hair.—Horse-hair was treated for fourteen hours with a mixture of 1 part nitric acid and 2 parts water, washed with water, and dried. A considerable amount of gas was disengaged upon adding the acid, and the mass then changed into a dark brown liquid, upon which floated a thick layer. The acid was of a dark brown colour, and furnished when dried at 266°:—

Carbon	48.91	49.24	49.50	49.23
Hydrogen ..	5.80	5.70	6.34	9.30
Nitrogen ..	14.13	15.03	14.74	14.90
Oxygen. ...	29.11	27.98	27.37	27.52
Sulphur ...	1.92	1.92	1.92	1.92
Ash	0.13	0.13	0.13	0.13

Xanthoproteic Acid from Proteine.—Coagulated albumen was dissolved in very dilute solution of eaustic potash, and sulphurous acid passed into the solution until there was no further reaction of sulphur upon acetate of lead. A small precipitate which was formed was

separated by filtration; the solution precipitated with acetic acid; the precipitate, after having been freed from adherent acetic acid by washing and from fat by ether, was treated for fourteen hours with a mixture of 1 part nitric acid and 3 parts water, mixed with water, poured upon a filter, washed, and dried at 266°. It furnished:—

			Mean.
Carbon	50.97	50.74	50.86
Hydrogen	6.56	6.65	6.60
Nitrogen	14.76	14.90	14.83
Oxygen	26.23	27.23	26.23
Sulphur	1.48	1.48	1.48

The baryta salt of this xanthoproteic acid prepared from proteine, when dried at 212°, furnished 12.69 per cent. baryta, and for the organic substance:—

	I.		II.	
Carbon	45.75	51.40	45.62	52.25
Hydrogen	5.09	5.84	5.27	6.03
Nitrogen	12 69	14.50	12.63	14.46
Sulphur, Oxygen	..	27.36	..	27.26

Xanthoproteic Acid from Cow's Horn. — The horn was freed from the outermost layer, and exposed for forty-eight hours to the action of one part nitric acid and two parts of water. The insoluble residue was mixed with water, which caused a precipitate in the acid liquid. It was mixed with the insoluble residue, the whole exhausted with ether, and then dried at 212°. The colour of the dried acid did not alter; it was yellowish-brown upon one occasion, while in another preparation it was of a pure yellow colour, like albumen. In this case, as with the latter substance, the whole was not dissolved. The water which after dilution rested above the precipitate deposited on further dilution a pale yellow sediment. This acid afforded, after being dried at 212°:—

				Mean.
Carbon	50.19	50.09	50.08	50.09
Hydrogen	6.32	6.21	6.27	6.21
Nitrogen	14.47	15.03	14.78	14.77
Oxygen	26.91	26.86	27.06	27.22
Sulphur	1.71	1.71	1.71	1.71
Ash	0.10	0.10	0.10	

Solution of neutral acetate of lead furnished with one of the xanthoproteate of ammonia a yellow precipitate, which became yellowish-brown on desiccation in the water-bath. This salt, dried at 212°, afforded 14.14 per cent. oxide of lead, and for the organic substance:—

	I.		II.		Mean.
Carbon	42.71	49.72	42.89	49.96	49.72
Hydrogen	5.50	6.45	5.49	6.40	6.45
Nitrogen	12.63	14.69	12.63	14.69	14.69
Oxygen, Sulphur	..	29.14	..	28.95	29.14

Xanthoproteic Acid from Fibrine.—Ox-blood is well beaten, the separated fibrine washed with water, digested for ninety-six hours with a mixture of 1 part nitric acid and 2 parts water, then mixed with water, washed, dried in the air, exhausted with ether, and dried in the water-bath. The fibrine changes its colour very slowly, with evolution of bubbles of gas. It retains its form, and very little is precipitated by water from the acid liquid. The xanthoproteic acid was of a dark brown colour. Dried at 266°, analysis afforded:—

	I.	II.	Mean.
Carbon	49.22	49.39	49.31
Hydrogen	6.25	6.23	6.24
Nitrogen	14.90	14.77	14.83
Oxygen	28.26	28.24	28.25
Sulphur	0.94	0.94	0.94
Ash	0.43	0.43	

Xanthoproteic Acid from Horses' Hoofs.—This substance, freed from the outermost layer, was exposed to the action of one part nitrie acid diluted with two parts of water for forty-eight hours, then treated as in the previous cases with water, dried in the air, and deprived of fat by digestion with ether. The form of the substance remained unaltered. Some gas was disengaged on the addition of the acid mixture. The precipitate which resulted upon the addition of water to the acid liquid was of a lighter colour than the undissolved substance, but acquired the same colour upon drying, which, however, was lighter than that from cow's horn. The analysis of the acid dried at 266° furnished:—

	I.	II.	Mean.
Carbon	49.33	49.60	49.47
Hydrogen	6.42	6 52	6.47
Nitrogen	14.00	14.27	14,13
Oxygen	28.67	28.03	28.35
Sulphur	1.35	1.35	1.35
Ash	0.23	0.23	

Xanthoproteic Acid from Cheese. — Some old cheese, with the outer surface removed, was reduced to a fine powder, exhausted with ether, and then treated for forty-eight hours with a mixture of one and a half part commercial nitric acid and two parts water. The acid, precipitated with water, was again exhausted with ether, and thrice digested with boiling alcohol. In the treatment with nitric acid the cheese gave off very few bubbles of gas, remained solid, and a thick layer of fat separated on the surface, which was removed. There was no odour of valerianic acid perceptible. The colour of the pure acid was yellow, and when dried at 266° it gave:—

	I.	II.	III.	Mean.
Carbon	50.82	50.63	50.54	50.66
Hydrogen	6.32	6.31	6.31	6.31
Nitrogen	14.52	14.38	14.04	14.42
Oxygen	28.20	27.54	27.97	27.78
Sulphur	0.93	0.93	0.93	0.93
Ash	0.21	0.21	0.21	

Xanthoproteic Acid from Wool.—Sheep's wool, cleansed with water and cut into small pieces, was digested for forty-eight hours with nitric acid (1 part acid and 2 water), and treated as above with water and ether, dried first in the air, and then at 266°. A few gas bubbles are disengaged on adding the acid, and the wool slowly acquires a light yellow colour. In this case some fat likewise separated. On analyzing the acid dried at 266° it furnished:—

			Mean.
Carbon	49.41	49.40	49.42
Hydrogen	6.50	6.35	6.42
Nitrogen	14.52	14.53	14,52
Oxygen	28.65	28.82	28.74
Sulphur	0.82	0.82	0.82
Ash	0.10	0.10	

Xanthoproteic Acid from Horn Proteine.—Grated horn dissolved at a gentle heat in weak solution of potash is treated with sulphurous acid in the same manner as the albumen, and precipitated with acetie acid. The precipitate, brought upon a filter, became agglutinated into a leathery mass, which was divided as well as possible, and digested for forty-eight hours with one part nitric acid and two of water, when it entirely dissolved. The light yellow liquid was first neutralized with ammonia, then mixed with an excess of milk of lime, filtered, evaporated to the consistence of a syrup, again dissolved, filtered, and precipitated with acetate of lead. The washed precipitate, dried at 266°, contained 14.00 per cent. oxide of lead, and the organic substance:—

	I.		II.		Mean.
Carbon	42.90	49.89	42.91	49.94	49.91
Hydrogen	5.37	6.24	5.38	6.25	6.24
Nitrogen	12.37	14.39	12.61	16.66	14.52
Oxygen, Sulphur	..	29.48	..	29.15	29.23

The substance which remained undissolved in the first treatment with potash was digested with a fresh solution of potash, and the proteine obtained digested for forty-eight hours with one part nitric acid and two of water. In this instance only a small portion of the substance dissolved. The insoluble residue was washed with water, digested with ether, dried at 266°, and analyzed; it gave:—

	I.	II.	Mean.
Carbon	50.54	50.67	50.61
Hydrogen	6.41	6.42	6.41
Nitrogen	14.52	14.90	14.71
Oxygen	28.49	27.97	28.23
Sulphur	2.04	2.04	2.04

Mulder draws the following conclusions from the results of this investigation:—

1. All the so-called proteine substances furnish the same substance by treatment with nitric acid.

2. Xanthoproteic acid is nitrous acid combined with proteine; and, where the latter is united with $S^2 O^2$, this acid likewise enters into the combination. Its formula is $2C^{36} H^{26} N^4 O^{12} + NO^3$.

3. In those cases where xanthoproteic acid is produced from nitric acid and proteine compounds with sulphamide, the sulphamide is decomposed, $S_2 O^2$ is formed from it, which acid then remains in combination with NO^3 and proteine.

4. Xanthoproteic acid is a hydrate, which parts with water on combination with bases.

5. Xanthoproteic acid is not deprived of the nitrous acid by the action of chlorine.

Now, since proteine unites with ClO^3, forming the compound $Pr + 2ClO^3$, and xanthoproteic acid likewise enters into combination with ClO^3, Mulder is of opinion that the empiric formula for proteine, $C^{36} H^{25} N^4 O^{10} + 2HO$, is as firmly established as any empirical formula can be.—*Scheidk. Onderzock.*, 5de Decl, 2de St., p. 139., and *Chem. Gaz.*

RESEARCHES ON QUINOIDINE AND β-QUININE.

By J. VAN HEIJNINGEN.

The following investigation was made with commercial quinoidine obtained in Holland. It is entirely soluble in acids and alcohol; but leaves in ether a residue from twelve to fifteen per cent., according to the different kinds. It neutralizes acids, and burns with an agreeable odour, leaving scarcely any residue. Elementary analysis of the entire mass furnished dissimilar results, the carbon and nitrogen being higher (as much as one per cent.) in proportion to its greater solubility in ether. This quinoidine consists of a mixture of at least four to five substances, viz., 1st, quinine (the α-quinine of the author); 2d, cinchonine; 3d, a base of very peculiar properties, which the author calls β-quinine; and 4th, of a resinous colourless substance, which, however, readily becomes brown in the air. The quinoidine was treated in three different manners.

I. *Treatment.*—100 grms. of quinoidine were exhausted with as little ether as possible, and the brownish-yellow solution separated from about fourteen grms. of a blackish-brown residue. The solution is decolorized with animal charcoal or the ether first removed by distillation; the residue dissolved in dilute sulphuric acid, and this solution treated with animal charcoal. The decolorized liquid is precipitated with ammonia, and the washed precipitate dissolved in ether. The ethereal solution obtained in either way is mixed with one tenth its volume of alcohol of 0.833 spec. grav., and left to evaporate spontaneously in a cool place. When the greater portion of the liquid has evaporated a considerable amount of crystals of β-quinine have separated, which were purified by washing with alcohol.

The alcoholic liquid decanted from the β-quinine was, after further evaporation, accurately saturated with sulphuric acid, and the remainder of the alcohol removed by evaporation. On cooling, crystals of β-quinine, having great resemblance to the sulphate of quinine, separated from this solution. The mother ley furnished a further quantity of these crystals, which were mixed with crystals of the ordinary sulphate of quinine and a dark brown colouring substance.

All the crystals of β-quinine are collected and purified by recrystallization from hot water. The ordinary sulphate of quinine is separated by dissolving the crystals in cold water with the assistance of a few drops of sulphuric acid, precipitating the solution with ammonia, carefully washing the precipitate, and dissolving it after desiccation in alcohol of 0.833 spec. grav. On

slow evaporation the β-quinine crystallizes, whilst the α-quinine remains dissolved in the alcohol.

The dark brown resinous residue left untouched by the ether is dissolved in dilute sulphuric acid, decolorized with animal charcoal, and precipitated with ammonia; the dry precipitate is dissolved in hot alcohol, and set aside to crystallize; it is this portion of the quinoidine which contains the cinchonine, which now gradually separates, whilst the brown colouring substance remains in solution.

II. *Treatment.*—100 grms. of quinoidine were dissolved in ether, the solution decolorized with animal charcoal, and the ether removed by careful distillation. The residual yellow resinous substance was accurately neutralized with dilute sulphuric acid, and the solution evaporated at a gentle heat, when a quantity of crystals separated on cooling.

These crystals were considered by Winckler to be ordinary sulphate of quinine, but this is an error; they are sulphate of β-quinine with a slight admixture of the former. The liquid separated from these crystals is concentrated until no further crystals separate, then dissolved in water, and decolorized. According to Winckler, ammonia precipitates from it pure quinoidine or amorphous quinine.

But if this precipitate, after having been dried, is dissolved in ether to which a little acid has been added, and the solution is left to evaporate spontaneously in a cool dry place, some more crystals of β-quinine are obtained from it. The separated liquid is saturated with dilute sulphuric acid; the alcohol evaporated. There is obtained on cooling, as in the first method, a further large amount of sulphate of β-quinine; the remainder of the liquid at last solidifies to a paste of crystals.

According to this method, therefore, the same results are obtained according to I., only with greater loss of material and time; for the β-quinine is decomposed under the influence of acids and heat, apparently by the presence of a colourless substance, which becomes brown and resinous in the air; so that it requires to be frequently decolorized, because these products of decomposition prevent the crystallization of the β-quinine still in solution.

III. *Treatment.*—100 grms. quinoidine were dissolved in dilute muriatic acid, the solution decolorized with animal charcoal, and precipitated with ammonia. The white flocculent precipitate soon contracted into a resinous cake, which became brown in the air. The well-washed and dried precipitate was dissolved in alcohol of 0.833 and concentrated; the dark solution deposited on cooling crystals which appeared to be pure cinchonine; after further evaporation the thick liquid was treated with ether, when more, nearly pure, cinchonine was obtained. The ether is removed by cautious distillation; the residue in the retort saturated carefully with sulphuric acid, when, on evaporating the solution, a large amount of β-quinine separates. The mother ley is evaporated until no more crystals are deposited on cooling; it is then dark brown, and water precipitates from it a blackish-brown resinous substance. After the separation of this substance the liquid is again precipitated with ammonia, and the precipitate dissolved in sulphuric acid. This last precipitation renders the evaporation of a large amount of liquid unnecessary, in which operation it would again become brown. The concentrated sulphuric solution gave on cooling crystals which consisted of a mixture of α and β quinine, which were separated in the manner above described. The liquid separated from these crystals was decolorized, precipitated by ammonia, the dry precipitate dissolved in ether, and treated as above.

Of these three modes of treatment, the first is certainly preferable, because a larger portion of the β-quinine is separated before acids and heat are applied. Pure β-quinine is as little changeable as α-quinine or cinchonine; it is only when mixed with other substances that it is so readily decomposed. If Winckler's pure quinoidine be kept for some time in closed glass vessels, it becomes darker at the surface; and this takes place very rapidly if the pale yellow-coloured quinoidine is kept fused for a couple of hours in a water-bath, or when it is dissolved in alcohol or in dilute acids and heated; the colour then soon passes from a pale yellow into a dark brown.

When the colourless quinoidine of Winckler is dissolved in dilute sulphuric acid so as to form a perfectly neutral solution, and it is then heated for a few hours until the colour has become dark brown, few or no crystals of β-quinine separate on cooling. From such a solution water throws down a black precipitate, and the liquid becomes lighter. If the solution is now precipitated with ammonia, and the precipitate dissolved in warm dilute sulphuric acid so as to form a perfectly neutral liquid, a large quantity of crystals of β-quinine separate; it is therefore beyond all doubt that the presence of the black substance prevents the separation of the crystals.

The fourth substance above mentioned can also be obtained colourless; it exists in the colourless state in the mixture with β-quinine, which Winckler calls pure quinoidine; in commercial quinoidine it is present partly in the colourless state and partly of a brown colour, having been oxidized by the oxygen of the atmosphere. This product of oxidation would consequently form the fifth constituent of quinoidine. However, from the author's experiments, nothing accurate can be stated of this substance, except that it is not an alkaloid, and is probably free from nitrogen; for the following analyses correspond to a mixture of the cinchona alkaloids with a non-nitrogenous substance. I. II. are the found results with quinoidine; III. the calculated composition of quinine; IV. the calculated composition of cinchonine:—

	I.	II.	III.	IV.
Carbon	72.81	72.69	74.1	78.0
Hydrogen	7.30	7.30	7.4	7.8
Nitrogen	8.47	8.89	8.6	9.1

It should be observed that the β-quinine in the anhydrous state has the same composition as α-quinine. It results, then, from the above numbers, that the quinoidine of commerce must contain, besides α and β quinine and cinchonine, a fourth substance, containing less carbon and hydrogen than quinine. In order to obtain further information on this point the substance considered by Winckler to be pure quinoidine, but which is a mixture of β-quinine and of a substance which turns brown in the air, was analyzed. On drying, the colourless substance became brown, and consequently the analysis has no value in reference to its composition; but it is only intended to prove that the supposed amorphous quinine cannot have the composition of quinine. A sample of this substance, dried at 266°, and which had become brown, furnished on analysis 74.441 carbon, 7.491 hydrogen, 7.466 nitrogen, and 10.602 per cent. oxygen. The quantities of hydrogen and carbon are the same, but the amount of hydrogen is 1 per cent. less than in quinine.

It is evident, therefore, that the so-called amorphous quinine, even when prepared according to the method directed by Winckler, is still a mixture.

β-quinine, $C^{20}\ H^{12}\ NO^2 + 2HO$.—It will be seen from the following, especially from the nature of the salts, that this is a very peculiar alkaloid, which in the anhydrous state has the same composition as anhydrous α-quinine; but it decidedly differs from it in the hydrated state; the α-base combines with 3 equivs. water, the base β with only 2. In some salts the latter likewise contains less water of crystallization than α-quinine. When prepared according to the methods previously described, it has the following properties:—It crystallizes from ethereal hot alcoholic solutions in large, transparent, klinorhombic prisms, which become white and opaque in the air, without, however, falling to powder. At 320° it melts to a colourless liquid, which forms on cooling a transparent resinous mass; when heated upon platinum foil, it burns with an agreeable smell, resembling the odour of Melilotus. At 46° it dissolves in 1,500 parts water, in 45 parts of absolute alcohol, and 90 parts of ether, whilst of boiling alcohol it requires only 3.7 parts and of boiling water 750 parts; from which solutions it again separates for the greater part on cooling. In this respect it differs essentially from α-quinine and from cinchonine.

The cold aqueous solution has a feeble alkaline reaction, is rendered turbid by alkalis, and furnishes a white precipitate with tannic acid, whilst nitrate of silver and protonitrate of mercury produce no change in it. The substance dried at 266° gave on analysis:—

Carbon	74.08	20 = 1500	74.076
Hydrogen	7.44	12 = 150	7.405
Nitrogen	8.55	1 = 175	8.642
Oxygen	9.93	2 = 200	9.877

In the drying at 266° it loses 10.8 per cent. of water, which corresponds to 2 equivs.; so that the formula of the hydrated substance is that given above, whilst in the anhydrous state it is $C^{20}\ H^{12}\ NO^2$. This is precisely the composition of α-quinine.

Salts of β-quinine. — β-quinine forms, like α-quinine, basic and neutral salts, which have a very bitter taste. Some are more readily soluble than the corresponding salts of α-quinine, for instance, the oxalate, tartrate, and acetate; on which account neutral oxalates, tartrates, and acetates produce no precipitate in solutions of a salt of β-quinine, whilst a precipitate is formed in those of the corresponding salt of α-quinine. Some, on the other hand, are more insoluble; for instance, the muriate and nitrate of β-quinine.

Basic Muriate of β-quinine, $2\beta Ch + ClH + 2HO$, is easily procured by saturating the base with dilute muriatic acid. It crystallizes in very transparent white crystals, is soluble in alcohol and water, and differs from the corresponding muriate of quinine only by containing 1 equiv. less water. The air-dried salt lost at 248° 4.79 per cent. water. The air-dried salt furnished on analysis:—

β-quinine	..	2 = 4050.0	85.2
Muriatic acid	9.48	1 = 455.5	9.9
Water	4.79	2 = 225.0	4.9

The corresponding salt of α-quinine contains 3 equivs. of water.

Chloroplatinate of β-quinine, $\beta CH, HCl + PtCl^2 + 2HO$.—The preceding salt, dissolved in water with the assistance of a few drops of muriatic acid, furnishes, with an excess of neutral chloride of platinum, an orange-coloured precipitate, which, when washed and dried, appears to consist of 1 equiv. chloride of platinum, 1 equiv. muriate of β-quinine, and 2 equivs. water. The air-dried salt lost 4.86 per cent. of water at 212°. It has, consequently, the same composition as the corresponding double salt of α-quinine. The air-dried salt furnished on analysis:—

Pt	26.25	1 = 1232	25.6
Cl	27.85	3 = 1333	27.6
HO	4.86	2 = 225	4.8
βCh+H.	42.55	1 = 2026	42.0

Neutral Muriate of β-quinine is obtained when dry muriatic gas is passed over β-quinine dried at 266°. It crystallizes from the solution in water, which was not found to be the case with α-quinine, which was treated in the same manner for comparison; this latter formed on evaporation a gelatinous mass. 100 parts of β-quinine, dried at 266°, absorbed 22.518 per cent. of muriatic acid gas; 100 parts of α-quinine, dried at 212°, absorbed 22.864 per cent.; the same quantity therefore. The calculated amount for these neutral salts is 22.4 per cent.

Basic Sulphate of β-quinine, $2\beta Ch + SO^3 + 6HO$.—Its preparation has already been described; it has a striking resemblance to the corresponding salt of α-quinine, but is more woolly and soft to the touch; it dissolves at 50° in 32 parts of absolute alcohol and in 350 parts of water, whilst the salt of α-quinine requires 740 parts of water at the same temperature. Moreover, the α-salt contains 7 equivs. of water.

The air-dried salt, heated to 266°, lost 12.838

per cent. of water. The air-dried salt furnished on analysis :—

β-quinine	..	2 = 4050	77.5
Sulphuric acid ..	9.58	1 = 500	9.6
Water	12.84	6 = 675	12.9

Neutral Sulphate of β-quinine is readily obtained by adding a few drops of sulphuric acid to the solution of the preceding salt and evaporating. It crystallizes, but is very soluble in cold water.

Nitrate of β-quinine.—An excess of β-quinine is digested with dilute nitric acid, filtered, and evaporated; it forms large crystals with a vitreous lustre. It differs from the corresponding α-quinine salt, as this does not crystallize under similar circumstances ; it must be first evaporated to expel the excess of acid, and be then dissolved in water, when it is also obtained crystallized.

Oxalate of β-quinine, βCh, $C^2 O^3$+HO, cannot be obtained by precipitating a salt of β-quinine by an oxalate, as is the case with α-quinine, on account of its easy solubility. The base is, therefore, accurately saturated with the acid. From hot saturated solutions it separates on cooling in crystals with a nacreous lustre. The air-dried salt, when heated to 248°, lost 4.32 per. cent. =1 equiv. water. It has, therefore, the same composition as the corresponding salt of α-quinine, On analysis it furnished :—

β-quinine		1 = 2025.0	78.3
Oxalic acid	16.58	1 = 450.0	17.4
Water	4.32	1 = 112.5	4.3

Tartrate of β-quinine is obtained with tartaric acid in the same manner as the preceding. It forms nacreous crystals.

Acetate of β-quinine is very easily soluble, and, therefore, difficult to obtain in crystals; if, however, its solution is evaporated to a syrupy consistence, some beautiful transparent crystals form in it in the course of a few days, which are distinguished in appearance from the nacreous crystals of the acetate of α-quinine.

From this similarity we may conclude that the β-quinine is likewise a febrifuge. Bauduin has found it to be quite as effective in cases of intermittent fever as α-quinine. Should this result be confirmed, the price of the preparations of quinine will be considerably reduced; for 100 parts of unadulterated quinoidine furnished—

3 per cent. of α-quinine,
From 6 to 8 per cent. cinchonine, and
From 50 to 60 per cent. β-quinine,

in an operation which, executed upon a large scale, would furnish a still greater amount of produce. The preparation of β-quinine is likewise not very expensive.—*Scheikund. Onderzoeck*, part V., No. 4., p. 234.

OBSERVATIONS ON THE PRECEDING ARTICLE.

By Dr. W. KNOP.

Besides the results contained in the preceding abstract, the author gives in the introduction an historical view of all that had been previously published on the question worth mentioning. After the discovery of quinine and cinchonine by Caventou in 1820, several chemists thought that a third uncrystallizable alkaloid occurred in the bark of the cinchonas. In 1820 Sertuerner described quinoidine, and ascribed to it a twenty times more powerful action against fever than to quinine. In 1830 Henry and Delondre decomposed quinoidine into quinine, cinchonine, a resin, and an alkaloid, which they called quinidine. Guibourt, who examined it at about the same time, found no quinidine, but quinine, cinchonine, and a yellow resin. Somewhat later Geiger showed that the quinidine of Henry and Delondre was crystallized hydrate of quinine, and that the quinoidine was a resinous substance which owed its antifebrile properties solely to the admixture of quinine and cinchonine. This was then generally admitted, even by Henry and Delondre, until Winckler, in 1843, asserted it to be amorphous quinine, combined with two not bitter resins, and contaminated with several other substances, as cinchonine, resins, &c., and described how it might be purified from them. Liebig, from analyses of purified quinoidine, arrived at the same view as Winckler, that quinoidine was amorphous quinine. Winckler subsequently announced that he had also detected amorphous cinchonine in it. Lastly, Roder published a paper, in which he asserted that, after separating the brown resin by means of protochloride of tin, the entire residue of quinoidine might be obtained crystallized, *i.e.*, the amorphous quinine might be converted into crystalline, and obtained with a portion of crystallized cinchonine. Winckler could not succeed in confirming this statement.

Under such circumstances the question what is quinoidine would be difficult to answer; but, if we consider the above facts after the admirable investigation of Van Heijningen, all these views are found to have some truth. Liebig's aim was to find a febrifuge which might be easily procured, so as to be applicable to poor practice. This gave rise to more rigid investigations; but even Heijningen's results do not completely clear up the question. It is evident that quinoidine which has been purified from the brown extract, when the separation was very complete, the mere analysis must lead to the view of the existence of an amorphous quinine, since the results given by Heijningen exhibit a perfect agreement between the composition of the anhydrous α and β quinine ; and that the cinchonine, the quantity of which is variable according to circumstances, may be present in so small a quantity as to exert no evident influence upon the analysis. It is also evident that Roder's statement may be correct, since Heijningen shows that in this, as in many other well-known instances, the brown extract prevents the crystallization of the β-quinine. That Roder, being taken up with the amorphous quinine, did not distinguish the new base, is easily explicable, when we recollect that Heijningen says that the sulphate of the β-quinine has almost exactly the appearance of the sulphate of the α-quinine, which Roder considered to be the salt he obtained. As regards the immediate use of quinoidine as a therapeutic agent, in opposition to which both Mulder and Heijningen have written, the investigations of the latter show that the β-quinine constitutes a febrifuge which was unknown in the earlier investigations ; and that when unadulterated quinoidine is given to the poor instead of the pure alkaloid the proceeding has always the advantage of being less expensive. Nor can there be any objection to this, provided the brown extract is not injurious.—*Pharm. Cent. Blatt.*, July 11, 1849; and *Chem. Gaz.*

ON THE SPECIFIC HEAT OF POTASSIUM.

By V. REGNAULT.

Dulong and Petit discovered that between the specific heats of simple bodies and their chemical equivalents the following law existed :—The specific heats of the simple bodies are in inverse proportion to their atomic weights. Among the small number of numerical results which these illustrious philosophers brought forward in support of their law, there were several which satisfied this relation ; but these atomic weights were subsequently found to be quite inaccurate. The anomalies which existed in the law of Dulong and Petit have for a long time led chemists not to use it in fixing the equivalents of substances which they could not succeed in establishing in a certain manner by purely chemical data. In my memoir on the specific heat of simple bodies I have shown that the anomalies detected in the law of Dulong and Petit were owing to the very inaccurate determinations of several of their specific heats ; but at the same time I observed that this law did not possess the degree of accuracy which they supposed, and that it was merely approximative. This is owing to the circumstance that the calorific capacity of bodies, as we obtain it by our experiments, contains several other elements, which it has hitherto not been possible to separate, in particular the latent heat of expansion and a portion of the latent heat of fusion, which the substances successively absorb in proportion as they soften, frequently long before the temperature considered as their melting-point. The changes which have for some time past been made in the numerical value of the equivalents of some of the simple bodies have in general diminished the differences which I had pointed out in my first memoir.

Nevertheless, among the large number of simple substances whose specific heats I was able to determine, there are still three which do not come within the law, unless the equivalents generally adopted by chemists are changed; these bodies are uranium, silver, and carbon.

Uranium exhibited an inexplicable anomaly, which led me to induce chemists to make this body the subject of further research. Shortly afterwards the beautiful experiments of M. Peligot showed that the substance hitherto regarded as metallic uranium was an oxide; and this able chemist succeeded in isolating from it the true metal.

With respect to silver, the law of the specific heats assigned to this metal an equivalent half of that generally adopted by chemists. The formula for oxide of silver ought consequently not to be written AgO, but $Ag_2 O$; it became similar to that of the protoxide of copper, $Cu_2 O$, and of the protoxide of mercury, $Hg_2 O$. I pointed out the reasons which should lead chemists to adopt this new equivalent for silver, especially the undoubted isomorphism of the sulphuret of silver with the sulphuret of copper, $Cu_2 S$, which it replaces in every proportion in some crystalline minerals ; the analogy of the chloride of silver with the chloride of copper, $Cu_2 Cl$, and this circumstance, that no salt of silver had ever been met with which was isomorphous with the corresponding salt formed by an oxide of the formula RO. These reasons appear so conclusive to me that I have no doubt chemists will soon adopt the equivalent of silver as deduced from the specific heat of that metal.

Carbon exists free in several states, and then exhibits very distinct physical properties. I have shown that very different specific heats correspond to these several states. It must be determined in what state the carbon enters into its chemical combinations ; and it is evidently that the specific heat of which is in relation to the equivalent. It is natural to suppose that it is that modification in which the carbon is most divided. Now, the calorific capacity which I found for a carbon derived from the decomposition of organic substances by heat corresponds to the equivalent 150, that is to say, to a number twice that of 75 admitted by the majority of chemists. I enumerated the reasons which gave great probability to the accuracy of this new equivalent for carbon ; among them there is one which appears to me to be decisive. We are at present acquainted with a very large number of substances derived from the organic kingdom, the composition of which is established with certainty ; all their formulæ exhibit this remarkable peculiarity, that the number of the equivalents of the carbon is an even number. Now, this fact is quite natural if the equivalent admitted by chemists is the half of the true equivalent : the sole exceptions are formed by two combinations of carbon, which serve to fix the old equivalent of this body, viz., the oxide of carbon and carbonic acid ; but there is no reason why we should write the formula of the oxide of carbon CO rather than C_2O_2 ; and with respect to carbonic acid, chemists write its formula CO_2, because they regard as neutral carbonates those which most commonly occur, as the carbonates of lime, of baryta, &c., and as bicarbonates the alkaline carbonates, which contain twice the amount of carbonic acid. The anomaly presented by carbonic acid disappears if, on the contrary, these last salts are viewed as neutral carbonates, as several chemists have maintained to the present time. The carbonates

eontaining a less amount of earbonic acid thus become basie, or subcarbonates.

There exists between the speeifie heats of compound bodies a law analogous to that just alluded to for the simple bodies, and which has proved to be true within the same limits. This law is as follows :—The specific heats of eompound bodies presenting the same ehemieal formulæ are reciprocally in inverse proportion to their equivalents. However, my experiments prove that, for this law to be general, some of the equivalents admitted by chemists must be modified.

The compounds of silver, the formulæ of which, when the oxide is written AgO, are similar to those of the corresponding compounds furnished by the oxides RO, constantly form exceptions to the law. But, if the oxide of silver is written Ag_2O, its salts, eompared with those formed by the protoxides Cu_2O, Hg_2O, whieh then have analogous formulæ, satisfy the law of specifie heat ; and the same applies to the binary compounds. The specifie heats of the compounds of silver, as likewise that of metallic silver, lead, therefore, to the same conelusion, viz., that we must adopt for silver an equivalent half that admitted by chemists.

My experiments have also placed in evidence another fact, whieh deserves attention. The formulæ KO and NaO are generally admitted for potash and soda. These bases thus present similar formulæ to those of baryta, lime, magnesia, the protoxides of iron and of lead, &e. If we adopt these formulæ for the alkaline oxides, the speeifie heats of their salts and those of the binary eompounds of the alkaline metals form exceptions to the law of specifie heats. But, if we write the formulæ of the alkaline oxides K_2O, Na_2O, the anomaly disappears. These bases then beeome isomorphous with the protoxide of eopper, Cu_2O, with the protoxide of mereury, Hg_2O, and with the oxide of silver, supposing its formula to be written Ag_2O. In my memoir on the specifie heat of compound bodies I have exposed the reasons which should induee ehemists to adopt this change. The following are the principal :—

No alkaline salt is known which is isomorphous with the eorresponding salt formed by an oxide RO ; and the oxides of the alkalis never replaee in indefinite proportions an oxide of the formula RO. Mineralogists, it is true, frequently admit these substitutions, which facilitate the establishment of their formulæ ; but it is a gratuitous hypothesis, whieh has already been abandoned with regard to several minerals as soon as their eomposition was better known. Lastly, according to Mitscherlich, the sulphate of silver presents the same crystalline form as the anhydrous sulphate of soda.

To eomplete this determination of the equivalents of the alkaline metals it beeame very desirable to obtain the speeifie heat of potassium. I have endeavoured to determine it several times, but have always met with great diffieulties. In the first place, it is difficult to obtain potassium in a pure state, and to experiment with it in eontaet with the air without its being altered ; and then its speeifie heat eannot be determined above 32°, because the metal softens and eontains a considerable amount of its latent heat of fusion. I have sueceeded in determining the speeifie heat of potassium in a very approximate manner, by cooling this metal in solid earbonic acid, and ascertaining the deerease of temperature which it produced upon a eertain quantity of naphtha eontained in a small calorimeter. By making a perfeetly similar experiment upon a known weight of lead, I was able to determine the relation between the speeifie heats of potassium and lead eonsidered under the same circumstances of temperature. Three experiments have given the following values :— 5.83, 5.77, 5.40.

The two first values are too great, because I was not able to prevent in my two experiments the ingot of potassium earrying with it the small quantity of solid carbonic acid whieh adhered to its sides, and produced too great a decrease of temperature. Now, the inverse relation of the atomie weights adopted by chemists is $\frac{1294.5}{490.0} = 2.64$, that is to say, very nearly half the relation of the speeifie heats found in my experiments. If, on the eontrary, the equivalent which I propose is adopted, this relation becomes $\frac{1294.5}{245.0} = 5.29$, which differs very slightly from the relation of the speeifie heats given by the third and most aecurate experiment. The specific heat of potassium leads, eonsequently, to the conclusion whieh I had arrived at from the speeifie heats of the eompounds of this metal, viz., that the equivalent of potassium should be doubled, and that the formulæ of the alkaline oxides should be written R_2O.

I have endeavoured to demonstrate by some direct experiments that the method whieh I have followed for the determination of the specifie heat of potassium is not liable to very great error. With this view I employed it in determining the speeifie heat of two bodies, the ealorific eonduetibility of which is eonsiderably weaker than that of potassium ; for instanee, phosphorus and iee. The experiment was made in the same way as for the potassium, merely substituting water for the naphtha in the calorimeter. Admitting for the speeifie heat of lead between — 108° and 32° the same number, 0.0314, whieh I found for this metal between 32° and 212° (a supposition whieh probably differs but very slightly from truth), I found for the speeifie heat of phosphorus :—

Between — 108° and + 50°	0.1740
M. Persoz found between — 5°.8 and + 44°.6	0.1788
I found between + 50° and + 86°	0.1887

In the last ease the phosphorus had beeome pereeptibly soft. From these experiments it is seen that the speeifie heat whieh I have found for the phosphorus at these low temperatures is that whieh would have been supposed *à priori* on admitting that the calorific capacity of this substance diminishes with the temperature.

The speeifie heat of ice between — 108° and 32° I found to be 0.474 ; Persoz and Desains both found 0.504 between —4° and 32°, *i.e.*, a number somewhat higher than I found ; but this should be the ease, as the speeifie heat determined in my experiment refers to mueh lower temperatures.—*Comptes Rendus*, xxviii., p. 326.

METHOD OF DETECTING THE PRESENCE OF STRYCHNIA.

By MR. L. THOMPSON.

As the following means of detecting the presence of stryehnia may oeeasionally be found useful in medieo-legal investigations, its publication can seareely fail to interest some of your readers. Having plaeed a drop of strong sulphuric aeid on a piece of glass, add to it a small quantity of the suspeeted substance, and stir the whole together, so as to favour solution ; then sprinkle over the mixture a little powdered bichromate of potash, and gently move a glass rod through the fluid. If strychnia be present, a violet eolour of considerable beauty will be almost immediately produced, which, after a few minutes, will fade into a reddish-yellow, but may be renewed by the addition of more bichromate so long as any stryehnia remains undestroyed in the mixture. In this way $\frac{1}{1000}$th of a grain of that alkaloid may be made to yield a very decisive indieation. The points to be noticed are, that sulphurie acid alone produees no apparent effeet, and that the aetion begins at onee around eaeh partiele of the bichromate, so that, if the glass be held in a vertical position, streams of a violet-coloured fluid may be seen to flow from eaeh particle ; and if, at this time, the whole be slowly stirred, the entire bulk of the fluid will speedily assume the same characteristic tint.

In conjunction with my friend Mr. Morson, of Southampton-row, I have thus examined the following alkaloids :—Morphia, brueia, aeonita, atropia, codia, nareotine, pierotoxia, einehonia, quina, solania, veratria, and phloridzia, but without notieing anything at all ealculated to throw a doubt upon the value of the indieation thus obtained, as a means of demonstrating the presenee of stryehnia. In these experiments the usual sourees of error were sought to be avoided by the employment of pure materials—the alkaloids having been manufactured with great eare. Compounds eontaining nitrie or muriatie aeid are, for obvious reasons, unfit for such investigations—the pure alkaloids and their sulphates being alone unobjectionable.—*Pharmaceutical Journal.*

THE SUGAR QUESTION.

By M. ST. LEON.

The author has, in "The Colonial Magazine" for June, shown that if the West India sugar-planter were to send eoneentrated cane-juiee and crude concrete sugar to Great Britain he would find some practical difficulties, and give a eomplete monopoly to the European refiner. This latter consideration has led to the projeet of erecting sugar-refineries in the eolonies. The newspapers of Trinidad, Barbadoes, St. Kitt's, &c., are now warmly reeommending tropical sugar-refineries.

But factories in the West Indies, for the sole purpose of refining, would have a still worse fate than the modern sugar-refineries in the neighbourhood of Calcutta, Madras, and other parts of India. The West India sugar-refiners will have to contend against a double monopoly ; and, whilst the faetory labourers and the sugar-planters dictated their own terms as regards wages and raw material, the sugar-refiners themselves will overbid eaeh other. At all events, this new seheme provides no more than those already explained for the great want of steady, regular, effeetive, and eontinuous labour in growing sugar-canes ; and without the means of planting and produeing properly and eeonomically this tropieal reed it is altogether useless to speeulate on the process of manufacturing it into sugar.

This scarcity of effieient agricultural labourers has been erroneously attributed to an apparently small ereole population. Barbadoes, has, however, 730 human beings to every square mile—a most dense population, even more eompact than than that of China. Nevertheless, the Barbadoes planters are still complaining with the rest of the West Indies.

The 27th of March, 1848, Philip Miles, Esq., M.P., was examined by the committee of sugar-planting, of which he was himself a member :—

" Chairman : Will you state to the committee what your view is with respect to immigration ?—My opinion of immigration is that its value has been overrated by a great many people. If I look at the population of the West Indian islands I find that it is something like a million, but from the whole of the West Indies not above 140,000 hogsheads of sugar are imported into England ; supposing you estimate the population employed in produeing this at only one hogshead per man,* which is, in comparison with the slave eolonies, very small, it gives only about 140,000 people engaged in making sugar ; supposing you import 140,000 immigrants, you

* One hogshead muscovado sugar of about 1,800 lbs. weight, divided by 300 working days of the year, will give only six pounds of sugar produced daily by eaeh individual. In the evidenee which was given before the eommittee of the House of Commons, in 1832, it was stated by Mr. Mayers, the agent for Barbadoes, that 200 days' labour would be required in Demerara to produce 5,000 lbs. weight of sugar ; this is at the rate of 25 lbs. per day, which is rather above four hogsheads yearly per individual. By this last ealculation the whole West Indian production of 140,000 hogsheads would require only 35,000 people out of 1,000,000.

would double your producing power at once. My opinion is that you do not require it."

We do not advocate itinerant immigration, such as the West Indies have received from Asia and Africa, but would strongly recommend European labourers emigrating with their families for tropical colonization.

In the British West Indies the labour for growing and manufacturing sugar is monopolized by the emancipated negroes. Instead of regular and faithful work, so much required by the prodigious vegetation of a tropical climate, the planter receives only scanty intermittent labour. When the labourers are most wanted nobody is to be found: the people are feasting for whole weeks together. This description of work, which often is no work at all, cannot be compared either with tropical slave labour or with European free labour.

The mischief arises from the improvident manner in which the emancipation of the negroes was effected; no provision whatever having been made for such a transition. The greatest boon for the industrious manumitted slave was to get rid of his former companions, outlaws, felons, and other ex-convicts. However, after the emancipation, just as in the time of slavery, the laborious, the lazy, the lawless ragamuffin, all the labourers, without the least distinction, were sent indiscriminately to the fields to work together on the same footing. It was not judicious to suppose that the negro of good habits would not seek for more independence, and try to work for himself at home. By his exertions he has formed an establishment of his own in some corner, and shrinks from going with his wife and children to a plantation, to work there amongst a West Indian rabble.

In place of letting all the negroes loose at once, if one portion only at a time of the most industrious had been emancipated, just at the beginning of the apprenticeship, and leases of tilled land granted to them, on condition of their cultivating sugar-canes, for a fixed price, this would have induced the remaining apprentice negroes to be of good behaviour, in expectation of being of the next manumitted fraction.

By such a measure the cultivated land would have been gradually tenanted by negroes of regular habits, and the planter, no longer a farmer, would have had all his time to devote to the manufacture of sugar only. As this manipulation is easily performed by European labourers, the whole work being under cover, the new sugar-manufacturer would at once dispense with hired emancipated negroes—the present evil of the British colonies.

Thus the defective state of the West India labouring class, with their gambols at Christmas and their feasts at Easter and August, would have presented no impediment to the manufacturing process of sugar during those periods, a loss which no pecuniary compensation can obviate.

Expelled from the sugar-house and distillery, and not trusted with hired land, the loitering negro, a modern helot, would be obliged to offer his labour for a small remuneration to the new crofters, his former companions. These cane-growers, far from being incessantly in want of steady labourers, not having to manage the complicated machine of the present planter, might now and then employ some wandering negroes at a low rate of wages.

At present the well-disposed labourer cannot faithfully perform the work for which he is hired, being under fear of encountering the hostility of the dissipated, who adopt a course of intimidation towards him. On the other hand, the sugar-planter, not having continuous work in all seasons, was unwilling to hire the labourer by the year. This naturally induced the latter to cultivate some provision-ground on his own account; consequently, at the planting season he is busy at home, whilst the planter is most in need of him. The latter cannot train the people to any improved process of manufacture, the capricious creole labourer generally leaving the sugar-house before he is half drilled.

The European *agronome*, when informed that the British West Indies are in possession of agricultural chemists, and of improved implements of husbandry, will suppose those countries in a high state of cultivation, while, in reality, the tropical agriculturist is still crawling in the ruts of a blind routine. The deplorable practice of cultivating continuously, without intermission, the same plant is to be found in the British as well as in the foreign West Indies. In spite of the costly herds of cattle kept for the sake of pen manure, the soil of the old plantations is greatly exhausted.

The farmers in North Britain having, by the use of guano, produced large turnips, the British planters were induced to employ the same means for growing large sugar-cane, and succeeded wonderfully. To be sure, when manured with guano the canes grow to a large size, and necessarily give a great amount of bagass and a good deal of trash; but the yield in sugar is comparatively small, and that, too, of an inferior quality.

The continental beet-grower does not use animal manure largely when planting beet-root for making sugar; these powerful agents are reserved for manuring cereals and green crops preceding and following the sugar-plant crop. By this system the saline matters of the animal manure so injurious to sugar are partly absorbed before the beet is planted.

The use of guano and other animal manures in the sugar districts requires a system of planting by rotation, which system will be introduced into the West Indies by letting the cane-fields to crofters, who, besides sugar, would also grow cereals and green crops for their stock of cattle and for the market.

The Royal Agricultural and Commercial Society of British Guiana, in its anniversary report of March 18, 1846, says:—

"Anticipating the period when cattle labour shall become common in cultivating the sugar-cane, your committee would suggest that improved methods of managing hay and pasture lands should be made the subject of one or more premiums, or at least of the society's strong recommendation. There can be no doubt that the price of provender for cattle may by the means pointed out be reduced greatly below that which it costs when imported."

The United States are the great purveyors of the West Indies. Even maize, which grows there almost spontaneously, is imported from a less genial climate. "The Americans will accept nothing but specie for their provisions, and they drain every shilling from the colonies." Having neglected to supply them with food during a part of 1847, some of the British islands were reduced to an alarming state of famine. In answer to the governor's speech delivered to the Legislative Bodies in 1848, the Honourable Board of Council of Barbadoes says:—

"The council are of opinion that those painful apprehensions of famine which during the past year more than once disturbed the community may be allayed, under Divine blessing, by a more extensive planting of provisions, and, if a judicious system of alternating crops be adopted, without any appreciable injury to the staple growth."

During the American war of independence, from 1775 to 1783, when no intercourse could take place between the United States and the British West Indies, "some thousands of Africans died in Jamaica from starvation." It is anomalous that the West Indies, which can produce several crops of cereals in the same year, "at a price below what it costs when imported," should depend for their food on less productive foreign countries.

However, the crofter, when receiving land on condition of planting only three fourths of it at a time in sugar-cane, will prefer growing his own corn to buying it with hard dollars, and will not follow the example of the present planter, "who, for the sake of getting an extended cane cultivation, has neglected all improvements, even the most important."

In the hand of the European agriculturist land gradually improves; with the tropical planter it is the reverse. Rich soil degenerates rapidly, so much so that an estate of thirty years' standing is called an old plantation, which is synonymous to exhausted land.*

To renovate the West India sugar estates it is absolutely necessary that the cultivation of the cane should be trusted to croftmen, to whom the sale of their staple growth would be assured by the land proprietor, having for that purpose a sugar-factory on his own account, or in partnership with some of his contiguous landowners.

Like wheat, canes ought never to be planted in an inferior soil. The crofter leasing good land, therefore, will return on an average twenty to twenty-five tons of canes (plant and ratoon), which, delivered to the mill, stripped of every part adhering exteriorly to the rind, will be worth 15s. per ton, the juice averaging 10 degrees of Beaumé's saccharometer.

Refining one hundred weight of muscovado sugar in a London establishment costs 4s. This includes every expense, interest on the gross capital, deterioration of buildings and machinery. The manufacturer of muscovado sugar has the bagass, his fuel, for next to nothing, which compensates the extra evaporation, and the mill-engine saved in refining; so that for manufacturing a hundred weight of muscovado the expenses may be fairly rated at 4s., which is the same price as if refining a cwt. of raw sugar.

112 lbs. of muscovado sugar and 36 lbs. of molasses being the products of half a ton of ripe cane, which costs 7s. 6d., 1 cwt. of muscovado, after deducting the value of the molasses, will cost 10s. to the manufacturer: this is without including the local taxes.

1,120 lbs., or half a ton, of sugar-cane costs	7s.	6d.
Expenses for manufacturing 1 cwt. muscovado from it	4	0
Together	11	6
Less 36 lbs. molasses at a halfpenny	1	6
Cost of a hundred weight muscovado sugar	10	0

After the grinding season, the manufacturer will have his establishment actively employed in refining some crude sugar from the small isolated plantations. This will afford indoor work for the European labourers during the whole year. If the crop last four months, the factory is working at the rate of sixteen months in the year; eight months in refining, and the process of manufacturing muscovado sugar going on night and day is equal to other eight months.

Even if the price of muscovado should fall as low as 11s. and 12s. per cwt. in the colonies, the landowner will still make an income. He receives a revenue by letting his property to crofters, and makes a profit on his refined sugar. Such an improved colonial factory has many advantages over the European sugar-refineries.

The cane-grower, receiving from £15 to £20 sterling for the produce per acre of cane, is better off than many European farmers. A contract between the crofters and the sugar-manufacturer will be adhered to, both parties being benefited by it.

The deficiency of the British West India labour has given a great impulse to the slave sugar-growing countries. Exaggerated accounts on the capability of Cuba and Brazil, published in England, have not a little contributed to increase their staple growth. Capitalists, when informed that the sugar production in the British colonies

* Alluding to similar gross mismanagement in Cuba, Consul-General Crawford, in his despatch to Lord Palmerston, adds:—"It is, therefore, advantageous to remove to virgin land." This is not so easy for mortgaged plantations, in which 100,000 to 150,000 dollars are already spent in clearing the land, in buildings, and for local improvements, &c., which altogether will be a dead loss if the estate were given up. However, the entail on the Cuban sugar plantations presents another difficulty to their translation.

was to be annihilated, were induced to lend money to the haciendados for fresh gangs of bozales from the African coast. But let sugar be grown on a new principle, so as to avoid hired creole labourers, the process for cultivating and manufacturing it will soon reach to a high pitch of perfection; then the refractionistas or money-lenders will decline making further advances for kidnapping negroes, which will naturally put a stop to the slave trade.

To promote rational industry in the British sugar-growing countries, model central factories ought to be immediately erected on cane land, cultivated by crofters, with a portion of the loan of £500,000 offered by Parliament as a relief to the tropical colonies, and thus this intricate problem—the sugar question—is solved. If the reader asks the reason why it has not been suggested by honourable parliamentary sugar committees? the answer, though in plain prose, is borrowed from a noble poet—"The causes, my dear sir, were too simple to be easily found out."

ON CHICORY-COFFEE, ITS HISTORY, MANUFACTURE, ADULTERATIONS, AND MEANS OF DETECTING THEM.

By A. CHEVALIER.

History and Manufacture.—The manufacture of a factitious coffee from the roasted root of chicory appears to have originated in Holland, where it has been practised for more than a century. It remained secret until 1801, when it was introduced into France by M. Orban of Liege and M. Giraud of Horning, a short distance from Valenciennes.

In a memoir upon coffee by M. Payssé, some details are given on the preparation of chicory-coffee in Holland. These were printed by Parmentier in the "Annales de Chemie" for 1806, and are as follows:—

"The chicory for this purpose is collected in spring; the roots are conveyed to the manufactory, stripped of their leaves, and washed to remove the soil.* They are cut into six parts, and then divided and dried. When dry, they are roasted in great cylinders like coffee. After the roasting, the chicory is reduced to a coarse powder.

"In Holland this chicory is then mixed in variable proportions with coffee; the resulting product is very bitter, which is considered by the common people to be a very salutary refreshment, which modifies the stimulant action of the coffee. Such a favourable idea has been formed of it that of late this preparation has been employed alone, without any addition of coffee; and nevertheless it possesses no other virtue than that of colouring more or less readily the water in which it is boiled or infused, of communicating to the liquid the bitter taste of the extractive substances contained in chicory, and of being far less expensive than coffee."

M. Payssé adds, that "peas, lupins, beans, beet-root, carrot, &c., have been employed as a substitute for coffee."

The manufacture of chicory-coffee, however, remained for a long time stationary and of little importance; but for the last twenty years it has extended considerably, and has become an object of commerce of great importance. Till within the last few years it was carried on principally near Valenciennes; but since then manufactories have sprung up in several localities, especially at Arras, Cambray, Lille, Paris, Senlis in Normandy, Brittany, and in England.†

The cultivation of chicory, to obtain the root for the purpose of converting it into coffee, has become a source of great prosperity for these districts. The plant requires a deep soil of good quality, and well prepared: the seed is sown in May, and the harvest takes place in October. Some time before collecting the roots the leaves are mowed, and cows fed with them. The roots are dug up with a spade, placed in heaps, and covered with straw to preserve them from frost.

The roots, thus collected, are cut at first longitudinally, and then transversely, in pieces from 5 to 10 centimetres in size; they are then carried into the drying chambers, which are heated with a kind of anthracite which produces no smoke. The roots are placed in layers of about 40 centimetres; they are frequently stirred to prevent them from burning and to facilitate the drying. Four such operations are made in about twenty-four hours. The roots dried by the above process are known by the name of cossètes. They are kept in granaries; but in general sold almost immediately to the manufacturers, who roast them according to the demand. When the roasting is nearly complete, 2 per cent. of butter is added, and a couple of turns given to the roasting-machine. This addition is made in order to impart lustre to the chicory, and to give it the appearance of roasted coffee. The substance is then emptied into iron vessels, and after cooling is crushed in vertical stone mills or between iron cylinders; it is then sifted, and during this operation a small quantity of a reddish colouring substance (*rouge brun de Prusse*) is added to give it the colour of coffee. The product is then weighed off, and sold in packets under a variety of names, but very rarely under its own; for instance, among others, Mocha powder, ladies' coffee, cream of Mocha, pectoral coffee, Chinese coffee, Tom Thumb coffee, Polka coffee, and colonial coffee.

We have stated that it forms a very important object of commerce; in fact, 12,000,000 lbs. are consumed in France, and a large quantity is exported. On consulting the tables of the commerce of France, it will be seen that from 1827 to 1836 there were exported from France 458,971 kilogrammes of chicory-coffee, of the value of 321,282 francs; and since this period the amount has vastly increased.

Adulteration.—This substance is very frequently mixed with other ingredients, the means for detecting which consequently vary. We shall briefly notice them.

I. Brick-dust, ochre, and earth may be detected by incineration and determining the amount of ash; 100 grms. of pure chicory-coffee furnish from 4 to 5 per cent. of residue; an excess would indicate fraud.

II. Adulteration with coffee-grounds. This is carried on upon a great scale in Paris. It is easily detected. A sample of the suspected chicory is dried in a water-bath, and a pinch thrown upon the surface of a glass of water; the chicory almost immediately absorbs the water, and sinks to the bottom of the vessel, whilst the coffee-grounds remain on the surface.

III. Adulteration with roasted bread, dirt, and remains from vermicelli, &c. This adulteration is generally made with crusts of bread collected in the streets, crusts which are not always very clean. They are roasted or rather burnt in the oven, ground, and mixed with the chicory-powder. This adulteration can be detected by iodine-water, as the product resulting from the decoction of pure chicory does not strike a blue colour.

IV. Adulteration with roasted acorns, which may be detected by iodine-water and by persulphate of iron, which in such a case strikes a black colour.

V. Adulteration with roasted corn, haricots, and peas may be detected by means of iodine-water.

There is no method as yet known of detecting the adulteration by roasted beet-root and carrot. *Journ. de Pharm.*, July, 1849.

* The roots are now no longer washed, as this operation is said to injure their value.

† For the last two years very large quantities of dry chicory have been exported from France into England.

ON THE COMPOSITION OF HONEY.

By M. SOUBEIRAN.

The honey of bees contains two kinds of sugar, one solid and the other liquid. The former of these is considered to be identical with the granular sugar which is deposited, after long standing, from solution of grape sugar, or from cane sugar which has been changed by the action of acids. The liquid sugar of honey has hitherto been but little studied. M. Biot, however, has shown that it possesses the power of rotating a ray of polarized light to the left.

My experiments have tended to prove that there are, in fact, three different kinds of sugar in honey: 1st, granular sugar, or the glucose of chemists; 2dly, a sugar possessing the power of rotation to the right, and which is capable of having this power changed by acids; and, 3dly, a sugar which rotates to the left, but with nearly double the energy of that which has been changed by acids.

I have found the sugar that rotates to the right, and which may be changed by acids, in common honey, but it especially abounds in the liquid honey as contained in the honey comb. The proportion is so large that a solution of this honey, having a power of rotation of +0.96° to the right, acquires, by the action of acids, the power of rotating in the opposite direction to the extent of 13.78° to the left.

I designate as liquid sugar of honey the fluid part which is extracted by submitting honey to the action of the press. My experiments have been made on sugar which was thus obtained in the year 1841, and which has been kept until the present time without undergoing any change—without giving any indication of crystallization. This circumstance is sufficient to distinguish it from that which has been changed by acids, as the latter always solidifies into a mass of granular crystals after being kept for some time. The liquid sugar of honey presents several characters in common with cane sugar which has been changed by acids. Like the latter it is uncrystallizable, and may be converted into the condition of barley-sugar, being transparent, solid, and easily fusible. It is also, in common with cane sugar that has been changed by acids, very susceptible of the action of alkalis, by which it is easily decomposed. Both these kinds of sugar have the same composition, and combine in the same proportions with the alkalis. Thus in most of their characters these two sugars assimilate each other, but they may be distinguished by the circumstances that the liquid sugar of honey absolutely refuses to assume the crystalline condition, and that it possesses the power of rotation upon a ray of polarized light to nearly double the extent that the other kind of sugar does.

The results of my experiments may be thus briefly recapitulated:—

Honey is composed of a mixture of three different kinds of sugar, of which one is the granular sugar previously known.

Another of the sugars present in honey resembles, in many of its characters, cane sugar which has been changed by acids, but it is distinguished by the circumstances that it never assumes the granular state, and that it possesses a left-handed rotatory power to a much greater extent than the other.

The power of rotation which the liquid sugar of honey possesses, at a temperature of 55.4° Fahr., and for a column of 100 millimetres (3.937 inches) in length, is equal to 33.103°, while that of cane sugar changed by acids, under similar conditions, is only equal to 18.933°.

The liquid sugar of honey retains the power of rotating the ray of light to the left even after it has been rendered solid (by evaporation). There are but a small number of bodies that possess this character.

The third kind of sugar found in honey is distinguished from granular sugar by its having its power of rotation changed by the action of acids, and it is distinguished from the liquid sugar of honey by its possessing a right-handed rotation, The proportion of this sugar, which is very considerable in the liquid honey as it exists in the honey comb, becomes much smaller after the honey has been kept for some time, and ultimately it entirely disappears.—*Comptes Rendus.*

STATEMENT IN CONTINUATION OF THE ONE PUBLISHED IN THE CHEMICAL TIMES OF AUGUST 11, 1849, SHOWING THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE AIR FROM AUG. 5 TO AUG. 11 INCLUSIVE, AS INDICATED BY THE EVAPORATION OF WATER FROM TWO COPPER VESSELS OR SCALES, ONE INSULATED AND THE OTHER NOT. ALSO THE READING OF THE BAROMETER, THERMOMETER, DIRECTION OF WIND, AND GENERAL STATE OF THE WEATHER.

Aug., 1849.	Barometer.		Therm.		Scales.				Wind.		General state of weather.
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Insulated	Non-Insulated	Morning.	Evening.	
5	29.90	29.95	62	62	..	20 N.	..	20	S.E.	NE.	Fine all day.
6	30.05	30.10	62	65	5 N.	..	..	5	SW.	SW.	Fine all day, but rather close.
7	30.07	30.00	65	72	..	20 N.	..	20	SW.	SW.	Fine all day, but oppressively close.
8	29.93	29.85	73	73	..	5 I.	5	..	SW.	SW.	Thunderstorm at four A.M.; fine rest of the day, and very warm.
9	29.75	29.70	65	66	..	..	..	..	SW.	Calm	Shower at noon; fine rest of day.
10	29.78	29.90	66	69	..	..	..	..	SW.	W.	Slight showers afternoon; fine rest of day.
11	29.93	29.90	71	73	..	..	..	..	SW.	SW.	Very fine all day, and evidently a violent thunderstorm in the west at eleven o'clock P.M., the outskirt only having reached here.

The electrical state of the air, compared to last week, is unquestionably low; but that condition having been followed by thunderstorms affords, at least, hope that the atmosphere is recovering itself. I was always disposed to look at the bright side of a question, and so strong is this feeling with me that I am now satisfied the health authorities will, ere long, deign to consider whether or not sewer exhalations are calculated, either directly or indirectly, to destroy human life.

Westminster-road, Aug. 13, 1849.

Franklin Coxworthy, Author of "Electrical Condition," &c.

FRANKLIN COXWORTHY'S DISCOVERIES IN NATURAL PHILOSOPHY.

[*Continued from page* 107.]

Pursuing the examination of Franklin Coxworthy's two first propositions, we must remind our readers that in our last we traced, as minutely as we could, the various stages through which he arrived at a correct conception of the formation of snow, which, in accordance with his theory, we find to be a compound of oxygen, hydrogen, carbon, and nitrogen; and that, during its decrystallization or thaw, snow is converted into water, ammonia, and carbon.

This conclusion involves considerations of the utmost importance, affecting both the animal and vegetable kingdoms; and, if worth anything, entirely dissipates hypotheses that have engaged the attention and obtained the concurrence of scientific men for ages. Amongst these hypotheses is the hitherto unquestioned doctrine of "the diffusion of gases," by which the elements constituting the atmosphere were supposed to be held together or combined; it having been admitted that the oxygen of which the atmosphere is deprived by combustion and respiration is restored to it by the vegetable kingdom. No attempt, however, had been made to show how, after the separation, combination was again effected! Whether or not diffusion operated alike on the gases in whatever proportion they might be mixed, the so-called doctrine left us uninformed. Or when or why diffusion ceased to act, and gravitation began to perform its function! In fact, this assumptive diffusion, one of those convenient terms that are sometimes used when reason stumbles upon a difficulty, and impatience jumps at a conclusion, was allowed to set aside, entirely, the principle of gravitation, although no one has ever disputed the fact of its universality. With this anomaly in scientific investigation Franklin Coxworthy's mind was very forcibly impressed, at an early period of his examination of the question; but it is amongst the latest to which he has given a rational and demonstrable solution.

Our readers are, doubtless, aware that the air we breathe is composed of one part of oxygen, the supporting principle of combustion and respiration, and four parts of nitrogen, a gas which is only distinguished by its negative properties. Nitrogen is neither a supporter of combustion, nor a combustible element. It does not possess either taste or smell. Nor does it appear to perform any particular function during respiration, beyond that of preparing the oxygen, by dilution, for the healthful performance of its use—the purification of the blood, and the maintenance of the heat of the system by slow combination with carbon. Without nitrogen the inhalation of oxygen, instead of promoting vitality, would cause instant death. Nitrogen also renders oxygen subservient to our will in the various operations to which combustion is applied; and of the extent to which it is consumed in this country, and the results that thence ensue, we shall now endeavour to give an approximate estimate.

No means exist for the solution of this important question by an investigation of the atmosphere itself; but by availing ourselves of the facilities which the atomic theory places at our disposal we can ascertain the amount with sufficient accuracy. What primarily is necessary to arrive at is the actual quantity of matter that is consumed, and, chemically, the constitution of that matter.

There are raised annually in this country thirty-five million tons of coals. Of this a comparatively small portion is exported; but which is more than compensated for by the use of wood, turf, and other materials for fuel. These thirty-five million tons, therefore, we may safely assume as the minimum yearly consumption, and as the basis of our calculation.

Coal is a compound of carbon with a small proportion of hydrogen. Carbon, during combustion and respiration, combines with the oxygen of the air in the proportion of twenty-seven to seventy-three, and hydrogen in the proportion of one to eight. But, in order to simplify the illustration, we will consider coal as if it were pure carbon, although our figures must, in consequence, be considerably reduced; there being a great difference, as we have previously shown, in the proportions in which oxygen combines with carbon as compared with hydrogen.

Now, thirty-five million tons, multiplied by seventy-three, and divided by twenty-seven, will give for the oxygen gas abstracted from the atmosphere no less a quantity than ninety-five million tons; and, as air is composed of one of oxygen to four of nitrogen, the weight of this gas annually liberated must necessarily be about three hundred and eighty million tons! which stupendous fact had escaped the notice of the scientific world until attention was directed to it by Franklin Coxworthy, in 1847, in reference to its influence on the animal and vegetable world,—a branch of the inquiry to which we propose hereafter to advert, our present object being to ascertain how far his objection to the doctrine of "diffusion" holds good, irrespectively of other evidence.

Continuing, then, our more immediate examination, we have to observe that the gases resulting from combustion and respiration are evolved at a high temperature, and must consequently ascend in the atmosphere. But we also know that carbonic acid gas, at the same temperature as the air, is of the specific gravity of 1.5 as compared with 1, or fifty per cent. heavier than air, and must therefore gravitate towards the earth. And during its subsequent transmission through the vegetable kingdom, of which it is the principal source of food, we are aware that its carbon is retained by the plants, the oxygen being released through the leaves in a cold state. And the nitrogen, which has a specific gravity denominated only 0.9722, nearly a fortieth part lighter than air, ascends to the upper regions; whilst the oxygen, with a denominated specific gravity of 1.1111, rather more than a tenth part heavier than air, is necessarily liberated near the surface. How, then, can we avoid concurring with the opinion of Franklin Coxworthy, that, if designed by nature to be subject to "diffusion," these elements would have partaken precisely of the specific gravity of air? And what becomes of "the doctrine of diffusion" when no two of the supposed constituents agree in specific gravity? When we see lead swim and cork sink we may be inclined to rely again upon "the doctrine of diffusion," but not till then!

We have not yet exhausted this portion of our subject.

THE WEATHER AND THE LEECH.

By WILLIAM HOOPER ATTREE, Esq.,
Formerly House Surgeon to the Middlesex Hospital.

In Hayley's "Life of Cowper" we find a letter addressed to Lady Hesketh, in which the poet acquaints her ladyship with this interesting fact at the close of the epistle:—"Yesterday it thundered, last night it lightened, and at three this morning I saw the sky as red as a city in flames could have made it. I have a leech in a bottle that foretels all these prodigies and convulsions of nature. No, not, as you will naturally conjecture, by articulate utterance of oracular notices, but by a variety of gesticulations, which here I have not room to give an account of. Suffice it to say, that no change of the weather surprises him, and that, in point of the earliest and most accurate intelligence, he is worth all the barometers in the world. None of them all, indeed, can make the least pretence to foretel thunder—a species of capacity of which he has given the most unequivocal evidence."

Taking these few remarks as my text, you will find the following observations accurate; and, if

you deem them worthy of a place in your journal, I shall be obliged to you to have them inserted.

1. If the weather proves serene and beautiful, the leech lies motionless at the bottom of the glass, rolled together in a spiral form.

2. If it rains, either before or after noon, it is found crept up to the top of its lodging, and there it remains until the weather is settled.

3. If we are to have wind, the poor prisoner gallops through its limpid habitation with amazing swiftness, and seldom rests till it begins to blow hard.

4. If a remarkable storm of thunder and rain is to succeed, for some days before it lodges almost continually without water, and discovers uncommon uneasiness in violent throes and convulsive-like motions.

5. In the frost, as in the clear summer weather, it lies constantly at the bottom; and in snow, as in rainy weather, it pitches its dwelling upon the mouth of the phial.

6. Perhaps it may not be amiss to note, lest any of the curious should try the experiment, that the leech was kept in a common two-ounce phial, about three fourths filled with water, and covered with a bit of linen rag. In the summer the water is changed once a week, and in the winter once a fortnight. This is a weather-glass which may be purchased at a very trifling expense. —*Pharmaceutical Journal.*

RESEARCHES ON EMULSINE.

By B. W. BULL.

The emulsine employed in the following experiments was prepared from sweet almonds, from which the oil had been removed by pressure. They are formed into an emulsion with three times their weight of water, and the whole exposed for twelve hours to a temperature between 68° and 78°. In this interval a yellowish-white coagulum separates on the surface; the liquid is of a light yellow colour, and furnishes a precipitate with acetic acid, which, however, no longer appeared after it had been kept for two or three days. Alcohol furnishes a precipitate which entirely redissolves on the addition of water. As soon as the coagulum had separated the liquid was filtered, and also the precipitate produced by the acetic acid. The emulsine was precipitated from the filtered solution with alcohol of 0.848 spec. grav., of which it required twice its volume.

The emulsine thus obtained, well washed with alcohol and dried in the air, is a transparent, gummy, readily-friable substance of a dark or reddish-brown colour, without odour and without any particular taste. It dissolves only after long standing or on trituration with water, leaving an insoluble residue, which contains, besides some phosphate of magnesia and some phosphate of lime, a considerable amount of organic substance. This insoluble residue, even when completely washed with distilled water so as to remove all soluble matter, still furnishes the characteristic reaction of emulsine with amygdaline. Four analyses of this residue furnished the following results:—

	I.	II.	III.	IV.
Organic substance. .	56	69.45	59.48	80.27
Ash	44	30.55	40.52	19.73

The solution of this emulsine is opalescent, and very readily converts amygdaline into oil of bitter almonds and prussic acid.

Emulsine which has been dried in vacuo over sulphuric acid has nearly the appearance above described; in general it is not so dark, sometimes having a brownish-yellow tint, and in other cases a brownish-red. When dried in the air, in proportion as the alcohol escapes it absorbs moisture with great avidity.

The precipitate of emulsine acquires a totally different appearance when it is first washed with strong spirit, and then with absolute alcohol, until every trace of water has been removed, and then dried in vacuo under sulphuric acid. It then forms a snow-white, very friable mass, which is perfectly opaque, without lustre, and far more soluble than the emulsine prepared according to other methods. About six grms. of emulsine was obtained from a pound of almonds after the oil had been expressed. If larger quantities are employed the time required for washing and filtration is considerably lengthened, and a more or less coloured preparation is obtained. If it is dried over sulphuric acid in a recipient filled with air it becomes transparent, gummy, and coloured by the absorption of water.

Certain substances prevent the reaction of emulsine with amygdaline; for instance, alcohol and acetic acid. The property of being precipitated by alcohol is not peculiar to the emulsine, but is owing to the phosphates which it contains in solution, and with which it is so intimately combined that it was impossible to separate the emulsine without destroying it.

Emulsine has an acid reaction. After it has been washed with alcohol until what passes through is perfectly neutral, the moist emulsine strongly reddens blue litmus-paper. Emulsine which has been dried and again dissolved is likewise acid, and this acid property it owes to the presence of phosphates in the almond emulsion. An emulsion of almonds, which was neutralized with lime-water and filtered, distinctly furnished the reaction with amygdaline; but the filtered liquid was not precipitated by alcohol, and it contained not a trace of phosphoric acid. Ammonia acts in the same manner. The liquid, it is true, becomes turbid on the addition of alcohol; but the turbidness cannot be removed by filtration, and is deposited only after some days as a scarcely perceptible precipitate.

When the neutralized liquid is set aside at the ordinary temperature, it begins in the course of a few days to be decomposed, with a disagreeable odour; a precipitate separates, but it no longer becomes acid.

[*To be continued.*]

ON AN AVENTURINA-LIKE PORCELAIN GLAZE.

By A. WACHTER.

Wöhler observed, that aventurina-glass obtains its gold-like brilliancy from crystallized metallic copper, separated from the base, which has been coloured brown by oxide of iron. In the aventurina-like porcelain glaze a similar effect is produced by the crystalline separation of green oxide of chrome from the brown ferruginous base.

The glaze is prepared in the following manner:—

31 parts of finely-washed dry porcelain-earth of Halle;
43 parts of finely-washed dry quartz-sand;
14 parts of finely-washed dry gypsum;
12 parts of finely-washed dry pieces of broken porcelain, are mixed with 300 parts of water, and well distributed and mixed with it, by repeatedly passing them through a canvass sieve.

To this paste, whilst being stirred, are successively added the watery solutions of
19 parts bichromate of potash;
100 parts sulphate of iron;
47 parts sugar of lead; and then as much liquid ammonia as will throw down all the iron. The potash and ammonia salts are removed by frequently washing the whole with spring-water.

The porcelain vessels having been heated to redness are dipped into the thus obtained paste-like mixture of the ingredients just mentioned, with chromate of lead and iron, and afterwards burnt in the porcelain furnace. They are then covered with a brown enamel, which, by the reflected light, appears to contain a large quantity of small flakes of gold.

A fragment of the glaze appears under the microscope, by transmitted light, to be a brownish transparent glass, in which many transparent, green, hexagonal laminæ of oxide of chrome, and some brownish ones (perhaps oxide of chrome and iron), are floating. Whilst the glaze is gradually cooling in the porcelain furnace, the oxide of chrome crystallizes from the glaze (a silicate of potash, lime, and alumina), which is saturated with oxide of iron, and appears, through the brownish base, to be of a gold colour. If the aventurina-like glaze be mixed with an equal quantity of colourless porcelain glaze, the vitreous base does not appear after the burning to be brown, but light greenish-grey, and the precipitated crystalline flakes have, in the reflected light, their natural green colour.—*Ann. der Chimie und Pharm.*

ON A METHOD OF ASCERTAINING THE QUANTITY OF GOLD AND SILVER CONSUMED IN ELECTRO-GILDING AND SILVERING.

By MAXIMILIAN DUKE of LEUCHTENBERG.

The objection of slight durability which has been made to articles gilt by the galvanic process is principally owing to the circumstance that only a very small quantity of gold is allowed to be deposited on the object to be coated. The determination of the amount of precipitated gold by weighing the gilt object is only practicable with small articles, as the scales are not sufficiently accurate for larger objects. The author, therefore, advises the determining the quantity of precipitated gold from the loss which the solution of chloride of gold employed experiences. For this purpose a decilitre of the liquid is evaporated to dryness, and the residue weighed; two grammes of it are then heated with sulphuric acid, the heat being finally carried to redness. The fused mass, consisting of gold and sulphate of potass, is now carefully extracted with water; and the gold remaining in the crucible heated to redness and weighed. After gilding with the solution examined, a decilitre is submitted to the above-described process; and, from the difference in the amount of gold in the two liquids, the quantity of precipitated gold is ascertained.

In the process of silvering with the ordinary liquid, which consists of cyanide of silver, cyanide of potassium, and chloride of potassium, a decilitre is evaporated, as above, to dryness, and the residue weighed; two grammes of this are then heated to redness, when the cyanide of potassium and carbonate of potass fuse, while the cyanide of silver is converted into paracyanide of silver, and is subsequently entirely reduced. After fifteen or twenty minutes' ignition the cold mass is exhausted with water; it is then heated to redness and weighed. Clay crucibles cannot be employed in determining the silver, as their porous mass imbibes a portion of the fused salt, and so produces a loss in silver.

THE CHEMICAL TIMES.

SATURDAY, AUGUST 18, 1849.

DRAINAGE, AND VENTILATION OF SEWERS.

To attempt more in the present state of the question than to determine a *principle* on which plans may hereafter be based would be futile; the suggestions we have hitherto offered have been made simply with a view to oppose the hasty adoption of any plan which circumstances might afterwards preclude the possibility of carrying out, or of which the execution would entail a ruinous expenditure upon the rate-payers—a consideration which should not be lightly disregarded in the present condition of the country, when the people are already groaning under the burden of excessive taxation.

We have already directed the attention of our

readers to the enormous amount of matter that will have to be dealt with, as calculated to preclude the possibility of arriving at any satisfactory system of drainage otherwise than by having recourse to natural means; and for our own satisfaction, as well as a hint to others, we have thought it desirable to refer to a civil engineer, in order to ascertain what really are the difficulties we shall have to contend with. For the reasons we have already assigned, we desired him to confine his calculations to the amount of water that will have to be got rid of, and the expense of disposing of it. This is what he states:—

"Supposing a shower to take place, similar to that which occurred on the 26th of July, 1849, during which .57 of an inch of rain was registered at the Royal Observatory, Greenwich, as having fallen, and calculating that the metropolitan districts under the control of the metropolitan and City commissioners of sewers cover 100 square miles, equal to a superficies of 2,787,840,000 square feet, there would fall about 132,339,066 cubic feet of water, which would fill a reservoir or channel extending from Vauxhall-bridge to Blackwall,—a distance of ten miles,—to the depth of 25 feet, supposing the said channel to be 100 feet wide.

"The foregoing quantity of 132,339,066 cubic feet of rain, which fell between one and four p.m., is equal to 12,254 cubic feet per second, and, reduced to weight, gives 765,875 lbs., to pump which a height of 20 feet would require a power equivalent to that of 27,850 horses.

"In average rains, about half an inch of water falls in twelve hours, which is about one fourth the amount of the foregoing in three hours; so that, under ordinary circumstances, the quantity to be dealt with would be about 3,000 cubic feet per second, and the power required to raise it 20 feet would be about equal to that of 7,000 horses.

"All this is exclusive of the 10,000,000 cubic feet of water supplied daily to the inhabitants of London by the several water companies, which alone would fill a tank of 1,000 feet square, 10 feet deep, every 24 hours, and would more than fill Mr. Phillips's tunnel of 19⅓ miles in length by 1,763,200 cubic feet.

"The 7,000 horse-power required to raise the water which falls during ordinary rains would involve the consumption of about 225 tons of coals per 12 hours, supposing the water to be raised only 20 feet; whatever additional height the water may have to be lifted must increase the consumption of fuel in a proportionate degree.

"Perhaps a comparison between the drainage of London and that of the Lake of Haarlem, in Holland, the most gigantic work of the kind ever yet undertaken, may not prove uninteresting.

"The Lake of Haarlem covers about 140 square miles, and is of an average depth of sixteen feet; it contains, therefore, 60,447,616,000 cubic feet of water. The Dutch Government have erected two, and propose to erect a third, steam-engine, with cylinders of twelve feet in diameter, which it is calculated will pump out the foregoing quantity of upwards of sixty thousand million cubic feet of water in twelve months; but at starting the water has to be raised from one to two feet only—just sufficient to discharge it over the bank of the lake; and the greatest height it will have to be raised, that is, when the last portion of the water is being pumped out, will be from 17 to 18 feet, giving an average at the most of 10 feet.

"The depth of rain which falls in London is about two feet per annum, and, upon the 100 square miles required to be drained, 5,575,680,000 cubic feet of rain descend annually. Add to this the 10,000,000 cubic feet supplied daily by the water companies, and we have a total of 9,225,680,000 cubic feet of water to be disposed of annually.

"If a tunnel be adopted, similar to that proposed by Mr. Phillips, the water of house and land drainage would have to be lifted at least 63 feet, because he proposes a fall of 42 feet in the length of his tunnel; therefore the 9,225,680,000 cubic feet of matter would have to be raised 6.3 times higher than the water of the Lake of Haarlem, and, the bulk being 6.5 times less, the work to be performed in the two cases is about equal. The expense in fuel cannot be estimated at less than £45,000 a year, to which must be added that of the purchase of machinery, repairs, pay of engineers, stokers, &c. &c.

"In dealing with the house drainage alone, without interfering with the surface or rain water, as proposed by Mr. Phillips, and adopting his tunnel, two steam-engines of 800 horse-power each would be required for raising and depositing the drainage in the reservoirs he is reported to contemplate for its reception."

Now, the boring for which the commissioners have voted the sum of £260 must surely have an object in view; otherwise it would be a mere reckless waste of the public money. We think we may take it for granted, therefore, that the intended boring is resorted to for the purpose of determining the depth at which receptacles for the filth of London can be safely constructed in the London clay. Now, it is quite clear that the least lift on which we may have to reckon will certainly be sixty feet, but probably very considerably more; how then to empty these receptacles? Of course, by machinery. Well, the working of this machinery alone, and the constant repairs which it would require, would entail a very large annual outlay—a consideration which we doubt not would in itself prove a formidable barrier to the practicability of the plan.

With these few remarks we dismiss the subject for the present, trusting that those to whom may be confided the important and onerous duty of determining on the most eligible plan will closely scrutinize the details of all the plans proposed, and duly estimate the expense of each part of the process.

Source of Electricity.—The earth is the great reservoir of electricity, from which the atmosphere and clouds receive their portion of this fluid. It is during the process of evaporation that it is principally excited, and silently conveyed to the regions above; and also during the condensation of this vapour the grand and terrific phenomena of thunder and lightning are made manifest to our senses. In order to form a correct estimate of the immense power of this agent in the production of electricity, we must bring to our view the quantity of water evaporated from the surface of the earth, and also the amount of electricity that may be developed from a single grain of this liquid. According to the calculations of Cavallo, about five thousand two hundred and eight million tons of water are probably evaporated from the Mediterranean Sea in a single summer's day. To obtain some idea of the vast volume of water thus daily taken up by the thirsty heavens, let us compare it with something rendered more apparent than this invisible process. President Dwight and Professor Darby have both estimated the quantity of water precipitated over the Falls of Niagara at more than eleven million tons per hour. Yet all the water passing over the cataract in twenty days would amount only to that ascending from the Mediterranean in one day. More recent estimates make the mean evaporation from the whole earth as equal to a column of thirty-five inches from every inch of its surface in a year, which gives ninety-four thousand four hundred and fifty cubic miles, as the quantity continually circulating through the atmosphere.

THE HEALTH OF LONDON DURING THE WEEK.

[From the Registrar-General's Return.]

The deaths in London during the week ending Saturday, August 11, were 1,909. The mortality is somewhat less than it was in the previous week. The deaths from all causes in the six last weeks were 1,070, 1,369, 1,741, 1,931, 1,967, and 1,909; of which 393, 630, 1,002, 1,173, 1,308, and 1,185 were by diseases of the zymotic class. Smallpox, scarlatina, and hooping-cough are comparatively quiescent; typhus is more fatal than it was. The excess of 901 deaths over the average is due to diarrhœa and cholera, which were fatal to 173 and 823 persons. The deaths from cholera during the six last weeks were 152, 339, 678, 783, 926, and 823. The decrease is gratifying; but it is right to observe that the improvement is chiefly confined to West London, Poplar, St. George, Southwark, Newington, Camberwell, and Lambeth. The deaths from cholera in the two last weeks were 29 and 48 in Wandsworth, 9 and 21 in Pancras, 4 and 14 in Islington, 3 and 10 in London city, 16 and 35 in Bethnal-green, 15 and 35 in St. Giles. The death from all causes on the north side the Thames (1,118) were 89 more than the deaths (1,029) of the previous week. The parishes which have not yet been visited must be on their guard. Those in which the epidemic has partially subsided should redouble their precautions. The epidemic of 1832 broke out in three successive eruptions; the first, commencing in February, was at its maximum in April and subsided; the second rose rapidly from June to July, and sunk again down to the second week of August; its course was very much like that pursued by the present epidemic. The deaths returned by the parish-clerks in the three weeks from July 17 to August 7, in 1832, were 968, 793, 661; which, allowing for the defects in their returns and for increase of population, are equivalent to 2,323, 1,903, 1,586, or 5,812 deaths in 1849, when the deaths registered in the corresponding weeks were 1,931, 1,967, 1,909, or 5,807 in the three weeks July 21 to August 11. A third eruption in 1832 broke out at the end of August, and extended to the first weeks of September; a fourth in 1833.

It is satisfactory to find that the deaths of 819 out of the 823 persons who died last week of cholera are certified. They were seen by qualified medical attendants. But it is to be feared that the advice was not obtained in time. The accounts of the sudden stoppage of the epidemic by prompt medical treatment and the house-to-house visitation are, perhaps, over-coloured. But a mortality as high now as in 1832 should not take place; it may be prevented by improvements in the treatment, by arresting the premonitory symptoms, by still earlier attention to the general health. Medical men are called when the people are dying; but it is then too late. If the families of the middle and higher classes were seen at intervals during the epidemic by their medical attendants, and a corps of medical officers employed by the guardians to visit the poor at short intervals, the present epidemic might very probably be cut short, and a third eruption be averted. The precise locality in which almost every victim of cholera lived is given in the present return under each district; would it not be practicable for the authorities to have all these and the neighbouring localities inspected? If this were done and proper precautions taken, the tragedies of Albion-terrace, Wandsworth-road, where seventeen persons died in two weeks in ten houses, could scarcely recur. Another case appears this week in the note under Hampstead. In the house, No. 6, Albion-terrace, five deaths had been registered—a Wesleyan minister's wife, aged 59; his mother, 80; a widow, 49; and two old servants. This is all we learn from the Clapham registrar. The registrar of Hampstead adds, that during the week an aged man came with a friend to Hampstead for change of air—breakfasted, dined, went to London to transact business at the Bank of Eng-

land, and after his return seemed "pretty well." At six o'clock the next morning he felt ill, and had medical advice, but died in eight hours. This old minister was apparently the last of his family, for he had seen his mother, wife, and servants die before him in Albion-terrace, and could not fly from the poison which he carried in his breast. Such scenes of desolation could scarcely happen without great negligence on the part of the people themselves and on the part of the authorities.

Deaths by Cholera registered in the weeks ending—

Districts.	April 14.	April 21.	April 28.	May 5.	May 12.	May 19.	May 26.	June 2.	June 9.
West	..	..	..	..	1	..	2	1	2
North	1	..	..	2	..	1	3	..	3
Central	..	..	..	..	1	..	..	3	8
East.....	1	1	1	1	1	..	..	2	3
South	..	..	..	1	..	..	..	3	6
	2	1	1	4	3	1	5	9	22

Districts.	June 16.	June 23.	June 30.	July 7.	July 14.	July 21.	July 28.	Aug. 4.	Aug. 11.
West	1	3	14	7	29	46	43	58	54
North	4	7	7	7	17	7	25	27	45
Central	3	5	35	31	55	72	97	93	116
East.....	4	13	23	14	46	110	104	127	132
South	30	21	45	93	192	443	514	621	476
	42	49	124	152	339	678	783	926	823

Total of 47 weeks from week ending September 23.

West districts	349
North districts	230
Central districts.....	568
East districts.....	847
South districts	2,970
	4,964

It will be observed that, of the 4,964 deaths from cholera, 2,970 occurred on the south side of the Thames.

Cases of Diarrhœa and Dysentery returned in the Metropolis in the same Weeks of Six Years.

Weeks.	26th	27th	28th	29th	30th	31st	32d
1844	14	13	21	43	51	59	66
1845	13	14	28	28	48	39	45
1846	37	72	90	129	161	195	201
1847	23	17	35	46	64	118	112
1848	48	62	70	103	187	154	128
1849	33	54	100	146	238	198	188

Cases of Cholera returned in the Metropolis in the same Weeks of Six Years.

Weeks.	26th	27th	28th	29th	30th	31st	32d
1844	1	..	..	2	6	12	5
1845	..	1	2	2	2	2	5
1846	3	4	8	20	26	23	37
1847	..	..	3	1	3	7	16
1848	3	7	9	21	26	21	19
1849	124	152	339	678	783	926	823

The following remarks are by the registrars of the respective districts named:—

St. Pancras; Camden-town.—Mr. Holl, the registrar, says:—"Paradise-place (a sad misnomer) is an open ground of about sixty or eighty yards square, round which twenty-four or twenty-five dwellings, if they may be so called, are erected. In the centre is a common privy for the general accommodation; about are heaps of decayed oyster shells, offal of every description, putrid vegetables, and piles of dung, making a most disgusting scene. All the water is obtained from an old pump which affords but a small supply, so the inhabitants of this place are sadly in want of that most necessary article. The house in which the death occurred is filthy in the extreme; it consists of four rooms, one of the lower ones being applied to the purpose of a stable in which a horse and dog are kept, and the other one is a receptacle for decayed vegetables and fish. This description, I am sorry to say, will apply to more than one house in this and the adjoining courts."

St. Giles; North.—Mr. Simpson, the registrar, states that "the number of deaths this week from cholera and diarrhœa in Church-lane and the district have increased, and that most of them have been buried in St. Giles without certificates. He adds that, in visiting the cholera patients on Tuesday last in Church-lane, in company with Dr. Lightfoot, he found Margaret Connolly in a state of collapse, lying on a mattress on the floor placed at the doorway of the room in which she lived, and that the stench from the privy in the yard opposite where she was placed was almost insupportable. The poor dying creature had about fifty or sixty people crowded around her, and, though she had been visited some hours previously by one of the medical staff of the parish, no medical aid had been given her because her husband objected to her removal to the workhouse. The above gentlemen prescribed, but she died seven hours after the attack; a child of the deceased, two years old, died two days afterwards of cholera, when the husband, with his infant three weeks old, and the mother-in-law, immediately left the neighbourhood, since which the two latter have been attacked; so Mr. Simpson was informed."

Bethnal-green; Sub-district, Hackney-road. Mr. Murray, the registrar, says, "I have to remark on the accompanying report, that 12 out of 13 cases of cholera therein contained occurred within about 400 yards of each other, the intervening space consisting of narrow streets and courts. There is an imperfect circulation of fresh air, the population is densely packed together, a family generally occupying only a single room, and there is little beyond surface drainage to take off the waste water. At 10, Turville-street, three deaths have occurred within a week."

Bethnal-green; Town, Sub-district.—Mr. Gregory, the registrar, says, "The six cases of cholera in Church-street occurred, as you will perceive by the numbers of the houses, within a very short distance from each other (besides one last week, as returned, at No. 158, who died on the 3d of August). The first, that of a tripe-dresser, or boiler; the neighbours complained of the effluvia arising therefrom. I am informed also that a very large cesspool was opened in the yard of the house adjoining, being number 155, on or before Thursday, the 16th ult., the day we had a very heavy storm and thunder. It was kept open for several days, and caused a very bad smell to arise, which was severely felt on Sunday following; but it is now covered over. The houses in Church-street are large and densely populated, the drainage bad, having only cesspools. The father of the child, No. 461, had died of cholera, in Collingwood-street, Hackney-road district. The wife removed to her mother's with the child, where it was taken ill and died, and the great-grandmother attended to and laid out the child, went home, was taken ill the same night, and died two days after. No. 466 and his wife lived in Hope-town, Church district; the wife died there of cholera, and, there being no convenience for the husband, he removed to a coffee-shop in Church-street, opposite to where the others died, was attacked with cholera, and died also. Nos. 469 and 470 are father and son, who died in the house of the before-mentioned tripe-dresser. There is no common sewer up Bethnal-green-road or Church-street, although it is the main road from Shoreditch."

Bermondsey; St. James.—Mr. Martin, the registrar, states that "two of the cases are sisters: the father had just recovered from cholera and gone to work; this day the mother was attacked, is now in collapse, lying in a room not eight feet square, in a cottage containing two rooms, the bodies of her children in coffins close to her bed. This cottage forms one of a group situate in Bird's-gardens, a locality principally inhabited by the lower order of Irish, where numbers of pigs have been kept until the last four days, with no drainage, and no water laid on, one pump in the garden, from which land-water is drawn highly contaminated by the surface drainage from the several pigsties and privies (which are always emptied into the garden); in an opposite house a child is dying of cholera; diarrhœa abounds. I had seven cases in one house this week."

Lambeth; Waterloo (first part).—Mr. Mears, the registrar, says that "the deaths from cholera, though still numerous, have been less than half the number of the preceding week, the numbers being 34 and 15. As before, full half the deaths have occurred in the locality of the boundary sewer. As an additional proof of the influence of the effluvia from that source on animal life, I have ascertained that a cowkeeper, whose premises are close to the boundary ditch in Little Duke-street, and whose wife died on the 4th, has, during his residence there, lost several valuable cows by death. The death at No. 12, Windmill-row, was the wife of a carpenter; she had only been confined seventeen days, and three or four days after delivery she was, through poverty, obliged to stand at the wash-tub. Cholera and death ensued."

CHOLERA.

On Saturday, the 11th instant, the following memorial was presented to the Board of Health:—

"The Memorial of the Inhabitants of the Borough of Lambeth,

"Showeth,—That your memorialists reside in that part of the metropolis known as the borough of Lambeth; that for several weeks past the cholera has been raging to a fearful extent in that borough; and that in the opinion of your memorialists the want of proper sanitary measures, and the large number of injurious manufactories which exist in the borough, have tended in a great measure to cause the large number of deaths which have recently taken place. That some of your memorialists were induced to make an inspection of that part of the borough where the mortality has been greatest, with a view to ascertain whether the parochial and other authorities had neglected their duty in not causing efficient sanitary measures to be adopted. The gentlemen who undertook this onerous duty first directed their attention to that part of the borough which extends from the archbishop's palace at Lambeth to Vauxhall-bridge. Here they found one of the most filthy districts which, perhaps, could possibly exist in any town. Directly opposite Lambeth Palace is a narrow ill-paved street, known by the name of Fore-street. A few yards up this street is a turning called Ferry-street. This, as the name infers, runs down to the water. Here were deposits, which had been left by the tide, of a most offensive nature—such as dead dogs and cats, human excrement, and other obnoxious matters, emitting a most offensive odour. There are several other courts and lanes in this street of a similar nature, all of which are densely populated. The mortality here has been very great. At the end of this street is High-street, out of which runs Princes-street. At the corner of this street is a large building, in the occupation of Mr. John Hunt, a soap-boiler, in the manufacture of which article bones and kitchen stuff are used, which lie in Mr. Hunt's yard until they become putrid, and cause the most obnoxious and unhealthy stench which it is possible to conceive, and which your memorialists believe must tend greatly to increase the mortality of the district. Lower down in Princes-street is the boneyard of Mr. Jared Terrant Hunt. Mr. Hunt is a dealer in what are called 'green bones'—namely, bones which are taken by the butchers from the meat whilst it is in its raw state; these bones are taken to Mr. Hunt's yard

to the extent of several tons daily, and, as they lay sometimes for weeks before they are used, of course they become putrid and emit a most poisonous effluvium, which almost renders it impossible for a stranger to pass through the street without vomiting. In this street there are also several other equally injurious and obnoxious trades carried on, such as grease-makers, manure-manufacturers, soap-makers, &c. It was to the fearful stench which is emitted from these places that Dr. Baley, the resident physician of Millbank Prison, attributed the cholera in that establishment; and, if such was the case, how much more injurious must it be to the health of your memorialists who reside in its immediate neighbourhood? There is no greater proof required than the registrar's returns, which show that the cholera was 500 per cent. worse in this borough than in any other part of the metropolis.

"It will be needless for your memorialists to point out any other of the streets in the immediate neighbourhood of those above mentioned, as the remarks which have been already made apply with equal force to all.

"Your memorialists, therefore, humbly pray that your board will immediately cause the nuisances to be removed—nuisances to which they believe may be attributed the deaths within the last three weeks of upwards of 500 human beings, and which, if suffered to remain, will, in the opinion of your memorialists, depopulate the entire district."

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Rees Reece, of London, chemist, for improvements in treating peat, and obtaining products therefrom. Patent dated January 23d, 1849. Enrolled July 23d, 1849.

This specification describes a process of obtaining from peat a new available product which the patentee denominates "paraffine," and which is adapted for illumination by being made into candles, or burnt in lamps. The process by which the patentee obtains his products is as follows:—

He submits the turf to combustion in a furnace, shown in the drawing accompanying the specification as being vertical, the part of it above the fire or grate-bars being lined with, or made of, iron; the ash-pit below the bars is closed, a pipe leading into it for supplying a blast of air to the furnace; the top of the furnace, which is the only aperture into it for the purpose of charging, is closed by a plate, which is removed when a charge is made, the object being to prevent the products of combustion from escaping into the atmosphere; to the upper part of the furnace a pipe for conveying off the gaseous products is connected, the other end passing into a closed receiver or cistern containing water; the end of this pipe dips below the surface of the water, to prevent any return of the gaseous products; to the upper part of this cistern, and above the surface of the water, another pipe is connected for carrying away the gaseous products; this pipe is the first of a series of horizontal pipes placed in a vessel of water; they act as a condenser, within which the gaseous products from the combustion of the peat in the furnace are condensed; the gaseous products remaining uncondensed in the condenser are conveyed away by a pipe, and applied to any purpose required; the tarry and other condensed matters are drawn off into any convenient recipient. The patentee prefers the obtaining tar and other similar products from the turf by combustion in a furnace to the ordinary process of distillation.

The second part of the specification treats of the production from the tarry and other condensible matters thus obtained, and also from similar products of turf obtained by the ordinary process of distillation, of the new available material which the patentee calls paraffine; he obtains this in the state of solid and liquid paraffine. The processes which the patentee adopts are as follows:—

The tar and the other condensed matters are subjected to the process of distillation, until about one half of the mass is distilled over at as low a temperature as possible; the other portion is then distilled over into a separate receiver or vessel; this second portion of the distilled products consists of the solid paraffine and the liquid paraffine, and a small portion of volatile hydrocarbons. The product is of a dark yellow colour, and the paraffine exists in a state of crystallization; this is separated from the liquid by filtration through fine hair sieves or other means; the solid paraffine is then melted and cast into moulds about two inches deep; it is submitted to pressure and again distilled and recast, and again submitted to pressure in a stearine hot press to extract further the liquid matters, taking care to raise the temperature as little above 100° F. as possible. The substance may then be made into candles. The liquid paraffine is to be distilled to remove the colour, and, if necessary, that operation may be repeated, and the liquid paraffine employed for illumination in lamps.

The patentee claims:—

First. The burning of turf in a furnace, subjected to a blast of air, for the purpose of obtaining therefrom inflammable gases and other products.

Secondly. The obtaining products from peat, called solid and liquid paraffine, by operating upon the tarry and other pitchy products of peat.

George Williams, of Tipton, in the county of Stafford, forge-manager, for a certain improvement or certain improvements in the preparing puddling-furnaces used in the manufacture of iron. Patent dated January 13th, 1849. Enrolled July 13th, 1349.

In exemplification of this invention, the drawings which accompanied the specification showed a puddling-furnace of the ordinary construction, which is built with sides and bottom of slabs of cast iron. In order to protect them from the action of the heat, a quantity of coarsely pulverized iron ore or scoria is placed up against the sides and bridges of the furnace, and also on the bed or sole; but this method of protecting the furnace the patentee avers gives rise to a considerable loss of iron in the process of puddling, the iron, when in a melted state, filling up the interstices between the roughly pulverized scoria, from which it cannot be disengaged, and is therefore lost. In carrying out this invention it is simply proposed that, instead of roughly pulverizing the iron ore or scoria, it shall be reduced to a fine powder, so that on the admixture of a quantity of water it will be reduced to a paste or plastic state. The scoria so prepared is afterwards fashioned by suitable moulds into bricks, lumps, or other shapes adapted for building or lining the puddling-furnace; these forms are afterwards dried and fired in the ordinary manner of firing bricks; with these materials the patentee proceeds to line or coat the surfaces of the puddling-furnace with which the iron comes in contact; in building in the lining a mortar or cement is to be used also made of powdered scoria, with water added, to render it sufficiently plastic for the purpose; there will thus be no interstices left for the depositing any iron during the operation of puddling, which may, therefore, be conducted without the waste mentioned.

The patentee does not confine himself to the precise method of carrying out the invention by following the means herein described, so long as the character of the same be retained; but what he claims is the method herein described of preparing puddling-furnaces (that is to say), by reducing the iron ore or scoria, or other substance with which the said furnace is prepared, to a fine powder, and making therewith a paste or clay, which said paste or clay is fashioned into bricks or other pieces, with which the interior of the furnace is lined or built, as described.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING AUGUST 9TH, 1849.

William Thomas, of Cheapside, merchant, and John Marsh, foreman to the said William Thomas, for improvements in the manufacture of looped fabrics, stays, and other parts of dress; also in apparatus for measuring. Patent dated August 9th, 1849; six months.

Arthur Howe Holdsworth, of the Beacon, Dartmouth, Esq., for improvements in the construction of marine boilers and funnels of steamboats and vessels. Patent dated August 9th, 1849; six months.

William Furness, of Lawton-street, Liverpool, builder, for improvements in machinery for cutting, planing, moulding, dovetailing, boring, morticing, tongueing, grooving, and sawing wood; also for sharpening and grinding tools, or surfaces; and also in welding steel to cast iron. Patent dated August 9th, 1849; six months.

John Knowlys, of Heysham Tower, near Lancaster, Esq., for improvements in the application and combination of mineral and vegetable products; also in obtaining products from mineral and vegetable substances, and in the generation and application of heat. Patent dated August 9th, 1849; six months.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in derricks for raising heavy bodies. Patent dated August 9th, 1849; six months.—Communication.

PATENTS RECENTLY EXPIRED.

W. Crofts, of Nottingham, machine-maker, for certain improvements in machinery for making figured or ornamented bobbin-net, or what is commonly called "ornamented bobbin-net lace;" and which improvements are in part in extension of part of the improvements for which letters patent were granted to him on the 23d day of December, 1834. Patent dated July 30th, 1835; expired July 30th, 1849.

W. Mason, of Camden-town, engineer, for improvements in the manufacture of steam-engine cylinders, pistons, bearings, pumps, and cocks. Patent dated August 6th, 1835; expired August 6th, 1849.

W. Mason, of Camden-town, engineer, for improvements in the manufacture of firearms and artillery. Patent dated August 6th, 1835; expired August 6th, 1849.

S. Faulkner, of Manchester, cotton-spinner, for an improvement in the construction of a machine for carding cotton and other fibrous substances. Patent dated August 6th, 1835; expired August 6th, 1849.

C. Douglas, of London, Esq., for certain improvements in ventilating subterraneous and other places; and in constructing an apparatus or apparata in which combustion is carried on; and also in applying certain fluids to various useful purposes; and in constructing an apparatus or vessel for the appropriation of such fluids. Patent dated August 10th, 1835; expired August 10th, 1849.

S. W. Nicholl, of Eltham, gentleman, for certain improvements in rendering condensing steam-engines portable, and applicable as a means of general transport on rail and other roads. Patent dated August 10th, 1835; expired August 10th, 1849.

L. Hebert, of London, civil engineer, for certain improvements in flour-mills. Patent dated August 10th, 1835; expired August 10th, 1849.

GAS FROM WATER.—Mr. Stephen White, the inventor of the hydrocarbon gas, recently delivered a lecture illustrative of its merits in the Queen-street Hall, Edinburgh, to a numerous auditory. The lecturer commenced by explaining the ordinary mode of making gas from coal,

after which he proceeded to describe the mode he adopted in manufacturing the hydrocarbon gas. He said he had devoted six or seven years to see if he could find some gas that would be at once free from impurities, superior to the gas now in use, and without the least injurious qualities. The mode he adopted was, in the first place, to decompose water by means of charcoal and iron. For this purpose he employed two retorts, in which he placed a quantity of charcoal and small scraps of iron. These retorts were heated until the charcoal and iron became of a red heat, when he supplied them with small drops of water, which combined with the carbon in the retorts and produced a gas. As this gas, however, required some substance to make it burn, he employed two horizontal retorts placed one above the other, and divided in the centre with a division, in which he decomposed a quantity of resin or tar, or some cheap material of that description, by making it pass through heated scrap iron or chain. In every 1,000 feet of the hydrocarbon gas he mixed 500 feet of the article produced from water, and the same quantity of that produced from resin and tar. The lecturer next referred to the cost of hydrocarbon gas, and prefaced this branch of his lecture by remarking that his agents in America and Russia were willing to supply him with any demands for resin, however large they might be. To manufacture 1,000 feet of this gas it required 25lbs. of resin and 13lb. of water. The cost of resin at the present moment was somewhere about 3s. per cwt., consequently 25lbs. would cost about 9d. The quantity of charcoal consumed in the manufacture of 1,000 feet of gas was about a quarter of a bushel, and, therefore, the cost of this article would be 1d. The cost of scrap iron he calculated at nothing, because when taken out of the retorts its value was considerably more than when first introduced. He had, therefore, no hesitation in saying that the hydrocarbon gas might be supplied, supposing it to be used on a large scale—say 300,000 feet per day—at somewhere about 1s. per 1,000 cubic feet. In reply to several questions addressed to him by Dr. Renton, Mr. Adam Black, and others, the following facts were elicited from Mr. White:—That in the case of an escape the hydrocarbon gas would be much sooner detected in a house than the ordinary coal gas—that the heat of the flame was nearly the same as that of the gas now in use—that while the materials necessary for the manufacture of 9,000 feet of ordinary gas would cost about 18s., exclusive of the apparatus, &c., the materials required for the production of the same quantity of hydrocarbon gas would cost 7s. 9d.—that the same apparatus which would cost £1,000 for the new gas would cost £3,000 for the manufacture of gas from coal—and that according to good scientific authority the hydrocarbon gas had 30 per cent. luminating power in its favour over that now in use. At the conclusion of the lecture, which was illustrated with brilliant illuminations and diagrams, a hearty vote of thanks was awarded to Mr. White for the information he had communicated, which that gentleman responded to in appropriate terms, stating his conviction that in less than six months the gas from water would greatly supersede the gas from coal, and become much cheaper and purer than it is at present. It was stated during the course of the evening, by Mr. Thomas Russell, that those who felt an interest in this invention would have an opportunity of seeing it tested on a large scale, at the Panmure Foundry, Cannongate, after Saturday next. After the usual compliment to Convener Weir, who occupied the chair, the proceedings terminated.—*Scottish Press.*

Royal College of Surgeons.—The following gentlemen, having undergone the necessary examinations for the diploma, were admitted members of the college at the meeting of the court of examiners on the 6th inst.:—Messrs. David Jones Whitty, Aberdare, Glamorganshire; Thomas Bryant, Clapham-road; Frederic Duke, Hastings, Sussex; Isaac Tucker, Westbury Leigh, Wiltshire; and George Johnston, New York. Admitted on the 10th inst.:—Messrs. Charles Henry Payne, Uphill, near Bristol; Archibald Prentice Childs, Bungay, Suffolk; John Parker, Chester; Robert Jones, Conway, Carnarvonshire; William Henry Peacey, Tewkesbury, Gloucestershire; Frederick William Armstrong Rawlins, Congleton, Cheshire; Samuel John Tracey, St. Bartholomew's Hospital; Richard Symes, Bridgwater; James Tilby, United States; Samuel Beeves, Plymouth; William Holman, Plymouth; Walter Monday, Olveston, Gloucestershire; and Bernard Chapman Dolman, Melbourne, Dorsetshire.—The following gentlemen, having undergone the necessary examinations for the diploma, were admitted members of the college at the meeting of the court of examiners on the 13th inst.:—Messrs. Richard Close, Dublin; Edward John Daniel, Archway-road, Highgate; Edward Snell, Clare, Suffolk; Robert Harrison Wilson, Howdon Pans, near Manchester; George Elin, Regent's-park; Thomas Wynne Williams, Denbigh, North Wales; Augustine Ernest Fitzgerald, Dublin; and Benjamin Alfred Robinson, London. At the same meeting of the court Mr. Charles Paget Mingaye passed his examination as a naval surgeon. This gentleman had previously been admitted a member of the college, his diploma bearing date May 30, 1845.

Apothecaries'-hall.—The following are the names of the gentlemen who passed their examination in the science and practice of medicine, and received certificates to practise, on Thursday, August 9:—John Langford, St. Leonard's-on-Sea, Sussex; William Martin Hatfield, Chilham, Kent; Louis Parnell; John Newton Coffin, 23, St. Aubyn-street, Devonport; and James Rhodes, Manchester.

Improved Method of Tempering Edge Tools.—For heating axes or other similar articles, a heating-furnace is constructed, in the form of a vertical cylinder, the exterior made of sheet iron, lined with fire-brick, 4 ft. 8. in. diameter, or of such outside diameter as to give it an inside one of 4 ft. and 3 ft. high. In the interior of this cylinder several fire chambers are formed—usually four. The inner wall of each fire chamber is 18 in. long, 4 in. from front to back, and about 4 in. in depth; forming, in the whole, a circle of 3 ft. 4 in. diameter. Under each there are grate-bars, and the air is supplied through a pipe connected with a blowing apparatus. A circular table of cast iron, 3 ft. 4 in. diameter, is made to revolve slowly on the level with the upper part of the said chamber. This chamber is sustained on a central shaft, which passes down through the furnace, and has its bearing in a step below it; a pulley keyed on to it serves to communicate rotary motion to the table. When the axes or other articles are to be heated, they are placed upon the table with their bits or steeled parts projecting so far over its edge as to bring them directly over the centre of the fire; and the table is kept slowly revolving during the whole time of heating. When duly heated they are ready for the process of hardening. The hardening-bath consists of a circular vat of salt-water; within the tub or vat, a little above the surface of the liquid, is a wheel, mounted horizontally, with a number of hooks around the periphery, upon which the axes or other articles are suspended. The height of the hooks from the surface of the liquid is such as to allow the steeled part only to be immersed. As soon as the hardening is effected the articles are removed from the hooks, and cooled by dipping in cold water. With the best cast steel, a temperature of 510° F. has been found to produce a good result in hardening in about forty-five minutes.—*Scientific American.*

On the Manufacture of Enamelled Copper at Canton.—When the copper has been shaped into the desired form it is cleansed, but not scoured; and afterwards wetted with water, and sprinkled with the enamelling composition intended to form the ground, which may be either white or coloured. The article is then put into a muffle heated by means of dry Nankeen coal (this is found to be the best fuel). When the ground has been produced, the article is withdrawn from the muffle and covered with an iron bell, in order that it may cool shortly; the ground may be then ornamented in the same manner as porcelain, and again passed through the muffle. Several specimens of enamel, and colours upon enamel, have been deposited at the royal manufactory at Sèvres, in order that the French manufacturers may be made acquainted with the art.

Indian Cobalt.—A new field of cobalt has been discovered in the East Indies, in the mountainous country of Rajpoolanah,—a district already celebrated for its mineral wealth, and principally for its rich and various copper ores and its alums. It is in one of the copper mines that this cobalt is found, lying abundantly in the state of sulphuret of great purity. It is accompanied by only one other substance, iron pyrites, which is highly magnetic, and easily separated from it by a loadstone of moderate power. The ore contains this admixture in the proportion of 9.22 per cent. The remainder of the mineral consists wholly of pyrites of cobalt, of the specific weight of 5.45, and the composition following:—Cobalt, 64.64; sulphur, 35.36. The Indian jewellers already use it advantageously for colouring gold, to which it imparts a rose tint of great delicacy.

TO CORRESPONDENTS.

"Mr. H. Baly, Warwick," is referred to No. 148, page 38 ("To Correspondents").

"A Constant Subscriber."—The gentleman whom our correspondent assails so unmercifully in his communication to us is willing to meet "A Constant Subscriber" in fair discussion, and to prove to him that his "vagaries" are not quite so absurd as our correspondent thinks them to be. We may be permitted to hint to "A Constant Subscriber" the propriety of eschewing *anonymousness* in attacks of the kind in which he indulges. One *bonâ fide* communication has in such matters more weight with us than fifty anonymous letters. With respect to his advice regarding the advisability of an aërial voyage with Mr. Green we are happy to be enabled to state that some of the facts advanced by Mr. C. rest in a measure upon the *statements* and *authority* of that intrepid aëronaut. To show the animus of our correspondent's communication, and the unfairness of his attacks, we need simply quote the following extract from his letter:—"Mr. C. should also tell us what his claims to originality are when he proposes to purify the filthy Thames by the use of peat charcoal and lime, two methods long since patented by other persons." Now, Mr. C. never proposed so gross an absurdity as the purification of the Thames by means of peat charcoal and lime. He simply proposes to "mix the matter collected in the sewer dams, previous to its removal, with a suitable proportion of peat charcoal or lime, which will serve to deodorize and solidify it, and, besides, will add to the high fertilizing properties sewer manure is known to possess." In conclusion, we beg to inform our correspondent that Mr. C.'s plans, for a more efficient drainage of the metropolis, have already obtained the approbation of *practical* men of some standing, and that it is by no means unlikely but they may, after all, and notwithstanding Mr. Chadwick's most unfair opposition, be permitted to have an equally fair trial with the other plans proposed to the commission.

"W. C. R."—Ward's essence for the headache is prepared as follows:—Take of liquor of ammonia, four ounces; English oil of lavender, half a drachm; camphor, one ounce; spirits of wine, one pint. Dissolve. The mixture usually sold by apothecaries for Ward's essence is simply compound camphor liniment.

"T. P. C." will receive a private communication.

"A Friend."—We are greatly obliged.

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ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXX.

(LECTURE CIII.)

VEGETO-ALKALIS—(*Continued*).

PREPARATION OF STRYCHNIA AND BRUCIA.

The following process (Corriol's slightly modified) for preparing strychnia and brucia is generally considered to be the most advantageous :—Boil the nux vomica in water. When the fruit is sufficiently softened take it out of the water, and crush it in the mill; replace the crushed mass into the water from whence you had taken it, and boil for two hours at the least. Strain with expression. Add fresh water to the grounds, and boil again. Strain, and boil the grounds once more in a fresh quantity of water. Pour the products of the three decoctions together, and evaporate the liquor to the consistence of a syrup; add alcohol as long as a precipitate continues to form. By this means the whole of the mucilaginous matter is removed, and the alcoholic liquor retains only igasurate of strychnia and brucia, colouring matter, and a little fatty matter. Strain the liquid off from the deposit, wash the latter with alcohol, and add the washings to the strained liquor. Distil off the alcohol, and evaporate the residuary liquid in the water-bath to the consistence of an extract. Redissolve this extract in cold water; this will remove the trifling amount of fatty matter present. Heat the solution, and add to it lime-water in excess; this will precipitate the brucia and strychnia, in conjunction with some colouring matter. Dry the calcareous precipitate, and redissolve it repeatedly in boiling alcohol of 80 Cent. Distil the alcohol finally off, and treat the residuary mass, which consists of strychnia, brucia, and colouring matter, with alcohol of 53 Cent. This will dissolve the brucia and colouring matter, leaving the strychnia undissolved. The latter alkali may then be finally purified by dissolving it in boiling alcohol of 80 Cent. From this solution it will crystallize upon cooling.

Evaporate the alcoholic solution of the brucia and colouring matter to the consistence of a syrup; let this cool, and, when cold, add to it perfectly cold dilute sulphuric acid slightly in excess. Let the mixture stand for two or three days, when it will be found converted into a crystalline mass of sulphate of brucia surrounded and soiled by a black mother liquor. Separate the crystalline mass from the latter by means of the press, and redissolve the crystals in water. Decolorate with animal charcoal, and precipitate the brucia by means of ammonia. Filter off the ammoniacal liquor. The filtrate retains still some brucia, which subsides in proportion as the ammonia evaporates in the air.

The essential point in this process is to prepare the sulphate of brucia in the cold; otherwise the salt will contract an intimate union with the colouring matter, from which it will afterwards be found exceedingly difficult to separate it.

M. Henry recommends the following process as preferable to Corriol's :—Prepare the decoction of the nux vomica as directed by Corriol; evaporate the product to the consistence of a thick syrup, and add to this, for every kilogramme of nux vomica, 120 grammes of quick lime mixed with water. Dry the mixture in the water-bath, and treat the dry mass with alcohol of 85 Cent., which will dissolve the strychnia, the brucia, and some colouring matter. Distil off the alcohol, and convert the residue into a nitrate of strychnia; purify this by several crystallizations, and precipitate the strychnia finally by means of ammonia. The Codex has adopted this process, with this modification, however, that it rejects the conversion of the strychnia into nitrate, and substitutes instead repeated crystallizations of the strychnia from alcohol.

The strychnia of commerce is frequently mixed with brucia, from which it may be separated by means of weak alcohol, which dissolves the brucia, leaving the strychnia intact. The latter should then be dissolved in boiling alcohol, and the alcohol distilled off again, taking care to leave a little alcoholic mother liquor, which will retain the last traces of brucia that may still be left. Or, the mixture of strychnia and brucia may be converted into nitrate; the nitrate of strychnia will crystallize, whilst the nitrate of brucia is incrystallizable, and will accordingly remain in the mother liquor. M. Robiquet recommends the following simple and easy method of ascertaining whether a sample of strychnia of commerce contains brucia or not :—Dilute the suspected sample in a little hot water, and add a few drops of acid. Boil the mixture, and precipitate boiling with ammonia. If the strychnia be pure, the precipitate will be pulverulent; if it contain brucia it will appear pitchy. This method is based upon the great difference of fusibility between the two alkalis.

Strychnia and brucia are used in medicine. They should be administered with the greatest caution. Brucia is said to act much less energetically than strychnia. Both alkalis are administered mostly in the pilular form, to spare the patients the disagreeable impression of their intense bitterness.

HENDERSON'S COLLYRIUM.

Take of Strychnia, 10 centigrammes.
Acetic acid, a sufficiency.
Distilled water, 32 grammes.
Dissolve.
This collyrium is applied in amaurosis.

SALTS OF STRYCHNIA.

This salt is prepared by dissolving strychnia to saturation in dilute sulphuric acid, filtering the solution, and evaporating the filtrate. The sulphate crystallizes in cubes, when perfectly neutral; in needles, when it happens to contain a slight excess of acid.

Sulphate of strychnia is soluble in ten parts of cold water.

It is used, medicinally, for the same purposes as strychnia.

The other salts of strychnia are prepared in the same way.

The sulphate of strychnia contains one equivalent of strychnia, one of sulphuric acid, and one of basic water. In the crystalline state it contains, besides these elements, seven equivalents (=13.5 per cent.) of crystallization water.

The nitrate of strychnia contains one equivalent of strychnia, one of nitric acid, and one of water.

The hydrochlorate of strychnia contains one equivalent of strychnia, one of hydrochloric acid, and two of water.

One part of crystallized strychnia is equivalent to
1.31 of crystallized sulphate.
1.17 " nitrate.
1.15 " hydrochlorate.

SALTS OF BRUCIA.

The salts of brucia are prepared in the same way as those of strychnia.

The sulphate of brucia crystallizes in four-sided prisms; it is efflorescent.

The hydrochlorate of brucia crystallizes in long needles; it suffers no alteration by exposure to the air.

The sulphate of brucia contains 1 equivalent of brucia, 1 of sulphuric acid, and 1 of basic water. In the crystalline state it contains, besides these elements, 7 equivalents of crystallization water (= 12.84 per cent.)

The hydrochlorate of brucia is formed of 1 equivalent of brucia and 1 of hydrochloric acid; it contains no basic water.

One part of crystallized brucia is equivalent to
1.1 of crystallized sulphate.
1 " hydrochlorate.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON THE AGE OF THE EXTINCT VOLCANOES OF AUVERGNE.

By Sir C. LYELL, F.G.S., &c.

[*Continued from page* 120.]

From this well-ascertained fact we are warranted in inferring that the volcanic eruptions had not commenced when the older subdivisions of the fresh-water groups originated. In Auvergne there can be no doubt that some volcanic explosions took place before the drainage of the lakes, and at a time when the eocene species of animals and plants flourished, in proof of which the Pont de Chateau, near Clermont, may be adduced; at this place a section of the rock is seen in a precipice on the right bank of the river Allier. Beds of volcanic tuff alternate with a fresh-water limestone, which is, in some places, as it were, deposited while showers of sand and scoriæ were projected from a neighbouring vent. This limestone contains the helix ramondi and other shells of the eocene species. Whether the volcanic sand was showered down from above, or drifted hither by a river, is immaterial to the argument. There are also many points in Auvergne where igneous rocks have been found by subsequent injections through clays and marly limestones, in such a manner that the whole has become blended in one confused and brecciated mass, between which and the basalt there is sometimes no visible distinct line of demarcation. In the cavities of such mixed rocks we often find calcedony and mesotype, stybilite and arragonite. These igneous products form the lowest members of the great series of volcanic rocks of Auvergne; and these repose for the most part on the granitic mountains. Doubtless there was a long series of eruptions, beginning with those of the eocene period, and ending, so far as we can infer from the evidence of fossil remains, with those of the miocene period. The order in which the various strata have been found in some of the ancient beds of Auvergne is exhibited as follows :—eocene lacustrive strata (lowest); miocene alluvium with bones; trachytic breccia; second miocene alluvium with bones; second trachytic breccia; and newer alluvium. In order to account for the situation of these beds of rounded pebbles and sand, we must suppose that, after the tertiary strata (eocene lacustrive strata) had been disturbed and exposed to aqueous denudation, a valley was excavated, wherein the first alluvium accumulated, and in which the remains of quadrupeds then inhabiting the country were buried. The trachytic breccia was then superimposed; this breccia is an aggregate of shapeless and angular fragments of trachyte, cemented by volcanic tuff and pumice, resembling some of the breccias which enter into the composition of the neighbouring extinct volcanoes of Mont Dor. On this rests another alluvium, which also contains the bones of miocene species, and this is covered with another enormous mass of tufaceous breccia. We suppose these breccias to have resulted from the sudden rush of bodies of water down the sides of a volcano at its moments of eruption, when snow, perhaps, was melted by lava. Such floods occur in Iceland, sweeping away loose blocks of lava and ejections surrounding the crater, and then strewing the plains with fragments of igneous rocks enveloped in mud or moyer. In these two alluviums MM. Croizet, Jobert, Chabriol, and Bouillet have discovered the remains of about forty species of extinct mammalia, the greater part of which, as yet, are peculiar to this locality, but some of them characteristic of the miocene period, being common to the faunas of Touraine, and asso-

ciated in other localities with marine miocene strata. Among these may be mentioned the mastodon minor, and M. arvenensis, hippopotamus major, rhinoceros aptorhimus, and tapir arsernenis. The elephas primigenius, a specics common to so many tertiary periods, is also stated to accompany the rcst. In some cases the remains are not sufficiently characteristic to indicate the exact species, but the following genera can be determined: the boar, horse, ox, hyæna, felis, bear, deer, canis, otter, beaver, hare, and water-rat. The only organic remains found as yet in the ancient alluviums appear to belong to the miocene period.

The Puy de Tartaret, one of the most modern cones of eruption in central France, is a conical hill of scoriæ, with its crater at its summit; its comparatively recent origin is proved by its standing at the bottom of a deep valley, excavated through the alternating beds of pumice, trachyte, and basalt, belonging to the more ancient volcano of Mont Dor, and partly through the subjacent and fundamental granite. It is further confirmed by the course of a powerful current of lava, which, proceeding from the base of the cone, flows thirteen miles down the channel of the river Couze, stopping at the town of Nechers, near Issoire. The lava occupies the old river bed, and is observed to contract in its dimensions in the narrow gorges, where it also gains in height, like the water of a river flowing through the arch of a bridge, and to expand again where the valley opens, where it spreads into a broad sheet, having a level surface. But, although these appearances prove that the lava has flowed as it would do now, if melted again, and made to descend the same channel, it nevertheless bears, in some parts of its course, the marks of considerable age. In one of the gorges the entire mass of solid basalt has been swept away by the torrent, so that the continuity of the stony current is interrupted for several hundred yards, at a point midway between its efflux from the cone and its termination. This implies a long period of excavation. In another place, about a mile and a half from St. Nectaire, an old Roman bridge, still passable, having two arches, each fourteen feet wide, spans a deep ravine, cut by the Couze through the middle of the lava, which is here of a columnar structure. The bridge is supposed by French architects and antiquaries to be of the date of the fifth century; yet the springing of the arches proves that when it was erected the ravine was of the same width and depth as now. Nevertheless, while signs of denudation such as these attest the vast amount of removal of hard rock since the lava flowed and was consolidated, the contemporary cone of loose incoherent scoriæ has stood in its exposed position at the very bottom of a valley, entire and uninjured, the rain water being instantly absorbed by the porous mass, and no rill being allowed to collect on its sides. If any flood of water had passed over Auvergne, if any inundation had raised the lake of Chambou thirty or forty feet, it must have carried away the perishable cone. The lake alluded to owes its origin to the damming up of the Couze by the volcano, and by landslips that accompanied the eruptions. But the most conclusive evidence of the antiquity of Tartaret remains to be adduced. When, in 1843, I revisited Nechers, the Abbé Croizet pointed out to me a locality near the lower extremity of the great current where fossil bones of extinct animals had been discovered in a meadow, between the base of the lava and the channel of the Couze, now ten feet lower in the level than the lava. In company with M. Bravard I explored the spot, and we saw for ourseves that the bone deposit passed under the lava, which in that part formed a mass thirty feet thick. M. Bravard has since obtained from beneath the stony current a considerable number of additional osseous remains referable to the genera equus, sus, tarandus, cervus, canis, felis, martes, putorius, sorex, talpa, arvicola, spermophilus, lagomegs, lepus, and, according to Mr. Waterhouse, crocetus or hamster, and others, besides the remains of a frog, lizard, and snake, and the bones of several birds. Mr. Owen has examined some of these bones, and recognises among them the equus fossilis and tarandus priscus, both extinct species, occurring in the caves of England, with the contents of which, generally, this assemblage of fossils from Auvergne appears to agree very closely. According to MM. Croizet and Pomel, there is a predominance of species not known to exist at present, with an intermixture of a few others, undistinguishable from quadrupeds, at present existing in Europe. Among the land shells associated with the bones were found cyclostorma elegans, clansilia rugosa, helix hortensis, H. nemoralis, H. lapicida, and H. obvoluta—all rccent, and, with thc exception of the last, now found in the immediate neighbourhood. In my opinion, the deposit of red argillaceous sand under the lava containing these remains was derived chiefly from volcanic matter which the eruption of Tartaret threw out, and the fossil animals perished by floods caused by those outbursts. That a similar fauna continued to live in Auvergne after the latest eruptions is to be inferred from the discovery of many of the same group of animals in the clefts of a lava current as modern as that of Tartaret, observed at Aubière, near Clermont. This fauna, so different as a whole from that now living in Europe, evidently inhabited Auvergne when the valley of the Couze had been excavated down to the same level as that over which the lava of Tartaret had flowed; yet its antiquity must be extremely great—the gradual dying out of species and the introduction of new ones taking place, according to all analogy, with extreme slowness. Those who have followed me in my calculations and estimate of the length of time required for the formation of the delta of the Mississippi will not be surprised that I regard a thousand years as a comparatively small period in respect of changes so important as have taken place in Auvergne. All the volcanoes of the modern class, of which the cone we have been considering is a type, were not formed at once, for the lavas of some stand at a greater height above the actual river courses, and repose on ancient alluvium formed when the valleys were shallower. To allow time for the ejection of these numerous cones and lava currents, of which there are several hundreds in central France, we require a long series of ages, all subsequent to the miocene period, to which another class of monuments of more ancient date are referable, as, for example, the bone-bearing alluviums, alternating with volcanic formations, of Mont Perrier, to which a distinct fauna belongs. Some of the valleys cut out of the more ancient lacustrive strata were only croded to half their present depth in the miocene epoch, and were occasionally filled up with miocene deposits and afterwards re-excavated.

In Auvergne it is possible to distinguish the relative ages of a great variety of alluviums containing the bones of terrestrial quadrupeds, in consequence partly of their preservation under the lavas of different ages, and partly their position on sides of valleys which were gradually deepened, no flood or return of the ocean having disturbed the surface, and mingled the fossils of one period with those of another, as has happened in England and most parts of Europe. The oldest fauna of land quadrupeds in Auvergne, that found in a fossil state in fresh-water strata of marl and limestone, older than the trachyte of Mont Dor, consisted of species of paleotherium, auspplotherima, anthraeotherum, opossum, &c., analogous in great part to those of the Paris basin, with some miocene forms associated and belonging to an upper eocene group, newer than the Parisian tertiarils, or the upper fresh-water formation of the Isle of Wight. Hence it follows that the whole succeeding revolutions in the animate and inanimate creation which have occurred in central France since the land emerged, vast as they are in duration, as compared with the era of more modern volcanoes, are, nevertheless, considerably posterior to the marine clay on which London is built, this last being one of those tertiary deposits which rank as but the moments of yesterday in the great calendar of geological chronology.

RESEARCHES ON PIPERINE.

By T. WERTHEIM.

The experiments hitherto published relating to piperinc arc limited to some elementary analyses. It is, however, well known how variable and doubtful such results are, unless they are checked by decompositions and combinations, even in the hands of the most ingenious experimenters, in establishing the constitution of very complex organic compounds. The first object was to prepare a double salt with platinum. It was obtained in beautiful crystals of a splendid dark orange-red colour, belonging to the hemiorthotype system. To prepare it, a concentrated alcoholic solution of piperine, which has been repeatedly recrystallized, is mixed with a concentrated alcoholic solution of chloride of platinum, and the mixture, after the addition of concentrated muriatic acid, left for several days to spontaneous evaporation. In the course of twelve to twenty-four hours the first crystals make their appearance; they then gradually increase in quantity, and when sufficiently concentrated solutions have been employed a very large amount is obtained. The crystals prepared in this manner are so large and compact that they may be collected on a funnel with a narrow neck without loss, and freed from adherent mother ley by rinsing with strong spirit. This double salt is very sparingly soluble in water; but it appears to experience a partial decomposition in contact with large quantities, muriatic acid being set free, and apparently unaltered piperine eliminated. It causes a strong burning taste upon the tongue, which probably arises from this decomposition. It is pretty readily soluble in cold alcohol, but far more so in boiling; on cooling, nearly the whole amount separates as a fiery orange-coloured crystalline powder. The chloride of piperine and platinum may be dried at 212° without alteration. At a little higher temperature it melts, and it is decomposed with considerable tumescence. It furnished on analysis the following results:—

C ..	54.61	54.40	54.53	..	70=5250	54.46
H ..	5.48	5.40	5.26	5.05	38= 475	4.93
Pl ..	12.60	12.68	12.75	12.78	1=1233.3	12.79
N ..	3.53	..	..	..	2= 354.1	3.68
Ch .	13.41	..	..	..	3=1328	13.77
O ..	10.37	..	..	..	10=1000	10.37

This per-centage composition leads, therefore, to the formula $C_{70}\ H_{37}\ N_2\ O_{10}+ClH+PtCl_2$, from which we immediately obtain for pure piperine the formula $C_{70}\ H_{37}\ N_2\ O_{10}$.

If we calculate the per-centage composition of piperine according to this formula, we have—

Carbon	74.29
Hydrogen	6.55
Nitrogen	5.01
Oxygen	14.15

If we compare these numbers with those obtained by Liebig, Pelletier, Regnault, Will, and Varrentrapp, and quite recently by M. Laurent, a very considerable difference is immediately evident; but if we admit piperine to contain 2 equivs. water of crystallization, which as usual does not enter into the composition of the platinum double salt, a very satisfactory agreement with the numbers obtained by Regnault and Laurent results. The formula $C_{70}\ H_{37}\ N_2\ O_{10}+2$ aq requires—

	Calculated.	Regnault.		Laurent.
Carbon	72.00	72.03	72.33	71.66
Hydrogen	6.69	6.72	6.84	6.66
Nitrogen	4.85	4.94	4.94	
Oxygen	16.46	16.31	15.89	

A comparison of these results will justify the above supposition; and the object in view did not appear to require further confirmation. I immediately proceeded to investigate the peculiar decomposition which piperine experiences at a high temperature in contact with fixed alkalis.

When an intimate mixture of piperine with three to four times its weight of a mixture of equal parts of soda and hydrate of lime is exposed in a retort in an oil-bath for some length of time to a temperature between 302° and 320°, a perfectly colourless oily liquid distils over in considerable quantity; and, if the above-mentioned temperature has not been exceeded in the course of the operation, not a trace of ammonia is contained in the distillate. The oily product exhibits the following properties:—It has a peculiarly penetrating lasting odour, a very acrid burning taste, which when strongly diluted becomes extremely bitter. I have kept a large quantity of this oily body several months in a flask, which was frequently opened, without any apparent change; it has a strong permanent alkaline reaction; it produces no violet colour with a solution of chloride of lime. In short, it entirely corresponds in its properties with a substance recently described by Mr. Anderson by the name of picoline, with the exception of a single important reaction. When, for instance, a somewhat large amount of this oily product is mixed with nearly an equal quantity of albumen, this is coagulated after some time, which is not the case with picoline; but it frequently requires more than a quarter of an hour.

To ascertain the composition of this substance, the double salt with platinum was analyzed. It was prepared by dissolving the original distillate in water containing sulphuric acid, avoiding an excess of acid; the solution was then evaporated to dryness in the water-bath, and the residue dissolved in absolute alcohol, in order to remove any trace of ammonia that might possibly be present. The alcoholic solution was now mixed with an excess of muriatic acid, and an alcoholic solution of chloride of platinum added, when an abundant precipitate of the double salt, in the form of exceedingly delicate feathery crystals of an orange colour, resulted. When very concentrated solutions are employed the entire liquid solidifies to a paste. Washed with alcohol and ether, and dried at 212°, this compound furnished the following results on analysis:—

Carbon....	23.39	..	12 = 900	24.07
Hydrogen .	2.94	..	8 = 100	2.67
Platinum. .	32.30	32.95	1 =1233.3	32.94
Nitrogen . .	..	..	1 = 177	4.73
Chlorine ..	..	..	3 =1328	35.59

The formula of the chloroplatinate of this volatile base is $C_{12}\ H_7\ N + ClH + PtCl_2$. There can, consequently, be no doubt that the volatile base obtained by the above process from piperine is, in fact, picoline. In a notice communicated on this subject, before Mr. Anderson had published his beautiful investigations on this new base, I had considered it to be aniline, judging solely from the above-mentioned numerical results. The different reaction above mentioned may possibly be explained from the circumstance that a considerable quantity of the base and of albumen were employed, and the result observed after the lapse of at least a quarter of an hour.

Having established the composition of the volatile product, I now proceeded to examine the solid residue in the retort. In the course of the operation the mixture assumes a dark cinnamon-brown colour. As long as heat is applied it is of a soft consistence, as the piperine melts at this temperature; when cold, it forms a hard agglutinated mass. If the heating has been continued sufficiently long, this mass contains but very little unaltered piperine, but a large amount of a new product, which may be obtained pure by treating the pulverized mass repeatedly with large quantities of water, which must not be hot; otherwise the particles cake together, and the water can no longer penetrate the mass.

After having removed in this manner the excess of the hydrate of soda, the dried residue is again pulverized, and digested several hours with cold alcohol to remove every trace of piperine; the residue is then mixed with hot water to which an excess of hydrochloric acid has been added, and the acid liquid boiled for some time. The acid should be added very gradually in order to avoid a too violent evolution of the carbonic acid. The muriatic acid dissolves the hydrate of lime contained in the residue, which when freed from lime becomes suspended in the liquid in the form of brown flakes; but in proportion as the boiling is continued the brown flakes unite, and form a homogeneous, soft, and compact mass of a dark brown colour, and the liquid becomes perfectly clear. If the soft cake of resin be removed from the hot liquid, and rinsed for a few moments in a little cold water, it immediately becomes perfectly brittle, and can be pulverized without difficulty when dry. It still contains a considerable quantity of hydrate of lime, and must, consequently, be again digested with dilute muriatic acid. When the resin has been treated in this way two or three times, and dissolved in boiling absolute alcohol, the cold solution is carefully mixed with small quantities of water until a slight milkiness appears. When this point has been carefully preserved, the liquid may be kept for several days without depositing the slightest precipitate; but, as soon as a couple of drops of muriatic acid are added to the liquid, the most complete precipitation immediately results. The precipitate is of a delicate yellowish-brown colour and very bulky. When collected upon a filter, washed with cold water, and dried at 212°, it forms a soft, pale yellow, perfectly tasteless powder, and is so highly electrical that on reducing it to powder it gives off a considerable quantity of dust. When the precipitate has been dried at the ordinary temperature *in vacuo* it possesses this electrical property in a less degree. On analysis it furnished:—

Carbon	73.56	74.17	128 =	74.02
Hydrogen	7.00	6.86	67 =	6.45
Nitrogen	4.08	4.08	3 =	4.09
Oxygen	15.36	14.89	20 =	15.44

The empirical formula to which these results lead appears at first sight not to stand in any very direct relation with that of piperine; but if the formula of the latter be doubled, and the formula of picoline be deducted from it, precisely the same group of atoms is arrived at:—

2 equivs. piperine .... = $C_{140}\ H_{74}\ N_4\ O_{20}$
1 equiv. picoline ..... = $-C_{12}\ H_7\ N$

= $C_{128}\ H_{67}\ N_3\ O_{20}$

This remarkable coincidence is readily explained by supposing the atom of piperine to be formed of two groups, of which the one is represented by the formula of picoline, $C_{12}\ H_7\ N$, and the other by $C_{58}\ H_{30}\ NO_{10}$:—

Piperine, $C_{70}\ H_{37}\ N_2\ O_{10} = C_{12}H_7N + C_{58}H_{30}NO_{10}$.

According to this view piperine would consist as it were of a saline compound, and the action of the soda-lime might be explained as follows:—

In the action of 1 equiv. hydrate of soda upon 2 equivs. piperine, 1 equiv. of the latter is decomposed. The soda takes the place of the separated picoline, and the soda compound formed immediately unites with 2 equivs. piperine to a kind of double compound:—

Before the experiment.

$(C_{58}\ H_{30}\ NO_{10} + \text{picoline})$
$(C_{58}\ H_{30}\ NO_{10} + \text{picoline})$ and NaO.

After the experiment.

$\left((C_{58}\ H_{30}\ NO_{10} + NaO)\right.$
$\left.(C_{58}\ H_{30}\ NO_{10} + \text{picoline})\right)$ and picoline.

This double salt, which we must imagine to be contained in the residue immediately after distillation, is decomposed on treatment with muriatic acid, which seizes the soda, leaving behind a kind of acid salt, in which for one equiv. picoline two equivs. of the electro-negative group are contained, *i.e.*, $2(C_{58}\ H_{30}\ NO_{10}) + C_{12}\ H_7\ N$. The empirical expression for this formula is $C_{128}\ H_{67}\ N_3\ O_{20}$, which agrees perfectly with the analysis of the product above described. It was, however, found impossible to prepare this hypothetical double compound. Most probably the soda is contained in it in such feeble union that it experiences a gradual decomposition by the action of water. We are far from thinking that piperine should be viewed, in consequence of these experiments, as a true salt; but our assumption that in piperine an electro-negative group is contained by the side of a basic group may, perhaps, explain the indefinite character of piperine as a base, and its exceedingly weak affinity for the strongest acids.

It results from this explanation of the process of decomposition that only the half of the picoline supposed to be contained in the piperine is obtained under the circumstances above mentioned.

It now appeared interesting to ascertain whether the decomposition might not be carried further by raising the temperature, the two equivs. picoline set at liberty, and, perhaps, the simple electro-negative group $C_{58}\ H_{30}\ NO_{10}$ obtained. It was found that the amount of produce might be considerably increased by raising the temperature of the oil-bath above 392°; but at this temperature a considerable quantity of ammonia passes over with the picoline. In the aqueous extract of the residue in the retort a peculiar substance is held in solution by the free alkali, which is precipitated on supersaturating the liquid with muriatic acid in yellow flakes; the amount obtained, however, was very small. This substance contains no nitrogen. It furnished on analysis:—

Carbon	71.41	58	71.45
Hydrogen	5.65	27	5.54
Oxygen.....	22.94	14	23.01

According to this analysis, which was made with the greatest care, as there was not material for a second, the composition of the substance produced by this further decomposition can be expressed by the formula $C_{58}\ H_{27}\ O_{14}$. It is impossible, therefore, to obtain the group $C_{58}\ H_{30}\ HO_{10}$, at least according to the plan followed; but, if we compare the two groups, we find that they stand in a very simple relation, for $C_{58}\ H_{27}\ O_{14} = C_{58}\ H_{30}\ NO_{10} - H_3\ N + O_4$. This new substance, consequently, has been formed directly from the electro-negative group of piperine by the separation of 1 equiv. ammonia and the assimilation of 4 equivs. oxygen.

The rational formula, $C_{58}\ H_{30}\ NO_{10} + C_{12}\ H_7\ N$, which we have developed for piperine from the previously enumerated facts, may be essentially modified; for instance, admitting in this substance, as a salt of picoline, 1 equiv. of constitutional water, as generally occurs in all the true salts of ammonia and the analogous bases, we obtain $C_{58}\ H_{29}\ NO_9 + C_{12}\ H_7\ N + HO$. The number of equivalents of hydrogen in the electro-negative group is by this change rendered exactly half that of the carbon equivalents; and the acid substance now appears as an oxide of a compound carbohydrogen.

If we attempt to apply this mode of conceiving the nature of piperine to the beautiful results with which Wöhler and Blyth have enriched our knowledge respecting narcotine, some extremely simple relations between this base and the two new bases which those chemists discovered, cotarnine and narcogenine, instantly present themselves. In the earlier notice above mentioned we just pointed to these relations; since then M. Laurent has arrived at conclusions which are in many respects analogous, by reflections of a very different kind and by ingenious combinations. We shall assume as the basis of our consideration the formula which Wöhler advanced for cotarnine, with the slight alteration of deducting from it one equiv. hydrogen. Now, if we deduct this formula $C_{26}\ H_{12}\ NO_5$ + one equiv. water from the formula of narcotine, $C_{46}\ H_{25}\ NO_{14}$, we obtain the expression $C_{20}\ H_{12}\ O_8$. If we further admit these two groups in narcotine to be combined in a similar manner as in piperine, forming a kind of salt in which cotarnine would represent the base and the other group the acid, and, starting from this assumption, take into consideration the formula of narcogenine, we instantly discover a remarkably simple relation. If we add, for instance, to the formula of narcotine the elements of one equiv. cotarnine + one equiv. water, the sum is the formula of narcogenine doubled:—

$C_{46}\ H_{25}\ N\ O_{14}$ = 1 narcotine.
$+ C_{26}\ H_{13}\ N\ O_6$ = 1 cotarnine + 1 aq.

$= C_{72}\ H_{38}\ N_2\ O_{20}$ = 2 narcogenine.

We do not think that this remarkable coincidence can be at all viewed as accidental, and do not hesitate to deduce from thence the following conclusions :—

1. The composition of narcotine is expressed by the following rational formula :—

$$(C_{20}\,H_{12}\,O_8) + (\text{cotarnine} + \text{aq}),$$

i.e., narcotine is the neutral pseudo-salt of cotarnine and of the above bracketed electro-negative group.

2. The atomic weight of narcogenine must be doubled. Narcogenine then acquires the following rational formula :—

$$(C_{20}\,H_{12}\,O_8) + 2(\text{cotarnine} + \text{aq}),$$

i.e., narcogenine is the corresponding basic pseudo-salt.

It results directly from the second conclusion that the atom of the chloroplatinate of narcogenine must be doubled; the atom of this compound would then contain 2 equivs. chloride of pla inum. This might at first sight appear anomalous ; but it needs merely a glance at the rational formula which we have advanced for narcogenine to remove this apparent anomaly.—*Liebig's Annalen* and *Chem. Gaz.*

ON THE ACTION OF HYPOSULPHITE OF SODA UPON THE CHLORIDE OF ANTIMONY IN THE PRESENCE OF WATER.

By A. STROHL.

Having let fall some drops of hyposulphite of soda upon a table which happened to be moistened with a little chloride of antimony, I was struck with the beautiful red colour which was produced in the course of a little time. Curiosity led me to attempt to produce this colour upon a greater scale, in order to ascertain how it is formed and its composition. My efforts were perfectly successful. A slight excess of hyposulphite of soda is mixed with chloride of antimony and water. The reaction takes place very slowly in the cold, but instantly on boiling; the product is allowed to deposit, the liquid decanted, the precipitate collected on a filter, washed with cold water, and dried at a gentle heat.

This substance forms an excessively fine crimson-red powder of a velvety appearance; it has great resemblance to mineral kermes, and is not altered by the air or light. Under the influence of heat it behaves exactly like that substance; its colour becomes darker and darker, and it finally fuses to a black mass, which is a kind of crocus. Hydrochloric acid dissolves it with disengagement of sulphuretted hydrogen and a slight deposit of sulphur; tartaric acid deprives it of a large quantity of oxide of antimony. These general properties led me to consider the substance as an oxysulphuret, the production of which probably takes place as follows :—

Two equivs. of chloride of antimony are converted under the influence of water into insoluble oxychloride and hydrochloric acid ; the hydrochloric acid reacts upon 3 equivs. of hyposulphite of soda, displacing 3 equivs. of hyposulphurous acid, which I represent, according to the views of M. Persoz, by (SO_2 S), *i.e.*, as sulphuric acid in which 1 equiv. of oxygen is replaced by 1 equiv. of sulphur, and which has been termed on that account sulphosulphuric acid. The following reaction furnishes a new proof in favour of that assertion :—The 3 equivs. of sulphosulphuric acid react in their turn upon the precipitated oxychloride of antimony. The 3 equivs. of sulphur combine with the radical of the chloride forming sulphuret of antimony ($Sb_2\,S_3$), whilst the 3 equivs. of chlorine of the chloride have an oxidizing action, and convert the sulphurous into sulphuric acid. The sulphuret of antimony combines in the nascent state with the liberated exide of antimony, forming the new oxysulphuret in question ($Sb_2\,S_3 + Sb_2\,O_3$) :—

$$2(Cl_3\,Sb_2 + aq) = Cl_3\,Sb_2 + Sb_2\,O_3 + Cl_3\,H_3$$
$$+ 3(SO_2S + NaO) = (Sb_2\,S_3 + Sb_2\,O_3)\text{ insoluble},$$
$$Cl_3\,Na_3 + 3SO_3\text{ soluble}.$$

It is seen, therefore, that the reaction takes place between 2 equivs. of chloride of antimony and 3 equivs. hyposulphite of soda with the presence of water; and that, on the one hand, insoluble oxysulphuret of antimony is formed, and, on the other, a mixture of chloride of sodium and sulphuric acid. It is also seen why a slight excess of hyposulphite must be employed, as with an excess of chloride the product is mixed with some oxychloride; in the other case it is mixed with a little sulphur, produced by the spontaneous decomposition of the excess of hyposulphurous acid. However, this admixture is less important.

To obtain a product without mixture, exactly 2 equivs. of solid chloride of antimony and 3 equivs. of pure crystallized hyposulphite of soda should be employed. This nearly corresponds to the following proportions :—

Crystallized hyposulphite of soda	60 parts.
Solid chloride of antimony.....	50 "
Distilled water	500 "

To confirm this theory I analyzed the product. Five grms. of substance, treated with a mixture of pure nitric acid and chlorate of potash, are converted into insoluble antimonious acid ($Sb_2\,O_4$); the whole of the sulphur is oxidized and converted into sulphuric acid. The filtered liquid furnished with chloride of barium 5.20 grms. sulphate of baryta, which represent 2.65 grms. sulphate of antimony. The formula $Sb_2\,S_3 + Sb_2\,O_3$ requires 2.69 grms. I propose to call this new substance cinnabar of antimony, from its colour, or normal oxysulphuret of antimony.—*Journ. de Pharm.*, July, 1849 ; and *Chem. Gaz.*

MEANS OF DETERMINING THE PURITY OF THE OTTO OF ROSES.

By M. GUIBOURT.

The high price of this article renders it a mattet of great importance to be enabled to decide upon its purity. The following means, if used in combination, will leave no doubt upon this point.

The physical characters can be but little depended upon; thus, the yellow colour with a tinge of green and its point of congelation may be readily imitated. Its odour also is so powerful that a certain quantity of any other oil of a somewhat similar odour might be added without sensibly diminishing that of the otto. The manner in which it crystallizes is of a certain amount of importance. When, after having been liquefied by a gentle heat, it is allowed to cool slowly and at rest, it remains as it were transparent, in consequence of the thinness and the perfect transparence of its long and pointed crystals, which resemble the blades of daggers; and, on varying their position as regards the light, these laminæ reflect all the prismatic colours. When the otto of roses has been adulterated with any uncrystallizable oil, which requires that its property of congealing should be imparted by the addition of spermaceti, it presents when solidified a number of fine needles, which, however, are not transparent, but render the mass uniformly semi-opaque. But for this test to be of any value, the otto must be allowed to crystallize slowly and at rest; otherwise it becomes nebulous and opaque, like that which has been adulterated.

The oil most frequently used for its adulteration is that of several species of pelargonium. The oils derived from the different species cannot be all identical, since M. Recluz has described one which is solid, whilst that which is met with in commerce is always liquid. The oil which I employed for comparison is called oil of geranium, and came from Nice. I also examined some oil of rosewood, which was distilled at Paris some years ago, and some of that found in commerce. Three reagents will serve to distinguish the pure otto—iodine, nitrous acid vapour, and sulphuric acid.

Test with Iodine.—A small quantity of iodine is placed in a small glass vessel with a wide mouth; around it watch-glasses are arranged, each containing one or two drops of the oils under examination, and the whole is covered with a bell-glass. At the end of a few hours the vapour of the iodine is found to have condensed upon every part of the interior of the bell-glass and upon the glasses containing the oils; but the margin of the watch-glasses containing the substituted oils is much more coloured than that of the glass containing the otto; and, when the former oils become brown, the latter retains its natural colour. After some hours the vessel containing the iodine may be removed; and then, the effect still continuing, the otto remains white, whilst the other oils become perfectly black. On exposing the watch-glasses to the air, the iodine which has condensed upon the margin of those containing the otto is volatilized, and the glass becomes almost colourless, whilst the others retain their black colour. I am satisfied that this test will serve, not only to determine the nature of the otto of roses, but also whether any oil of geranium or rosewood is present in it or not.

Nitrous Acid Test.—For this I use a small glass vessel, placed upon a plate. 10 or 15 grms. of concentrated nitric acid are placed in it, and some copper turnings added. Around this watch-glasses are placed, containing one or at the most two drops of the oils, and the whole is covered with a flat bell-glass. In a few minutes the oil of rosewood acquires a dark yellow colour; the otto acquired nearly the same colour ; whilst the oil of geranium becomes of an apple-green colour, and retains it for some time.

This test will serve to distinguish the two oils when in a state of purity, and may even serve to recognise oil of geranium containing the otto, because of the yellow colour which it imparts to the latter ; but it is evident that it cannot serve to determine the presence of the oil of geranium in the otto of roses.

Sulphuric Acid Test.—One or two drops of the oil to be tested is put into a watch-glass ; the same number of drops of very concentrated sulphuric acid are added, and the two fluids mixed with a glass rod. All the oils are rendered more or less brown by this proceeding; but—

The otto of roses retains the purity of its odour.

The oil of geranium acquires a strong and disagreeable odour, which is perfectly characteristic.

The odour of the oil of rosewood is increased, and becomes somewhat unctuous. It is not, however, characteristic.

The commercial oil of rosewood acquires an odour distinctly like that of cubebs.

Of these three methods, that with sulphuric acid is by far the best for distinguishing the otto of roses from the oil of geranium, and for the recognition of the second in the former. The iodine test is also very certain, but it requires considerably more time. The nitrous acid test will serve to recognise the two oils when not mixed, or even to detect the otto of roses in the oil of geranium ; but not the latter when mixed with the former.—*Journ. de Pharm.*

RESEARCHES ON EMULSINE.

By B. W. BULL.

[*Concluded from page* 128.]

Emulsine does not coagulate, but at a boiling heat it behaves in a very peculiar manner. Between 95° and 96° its solution becomes turbid; at 113° it becomes opaque and milky, and between 185° and 212° it gradually deposits a snow-white granular precipitate. If the liquid is boiled for a few minutes the filtered solution, each time that it is heated to boiling, becomes quite opaque, and deposits a copious flocculent precipitate : on cooling this entirely redissolves. This experiment can be repeated several times with the same result. The granular precipitate first formed amounts to about ten per cent. of the emulsine employed. It is perfectly white, can be easily reduced into a very fine powder, and leaves on incineration a neutral ash, which in one experiment amounted to 48.74, and in a

second to 59.11 per cent., and consisted of phosphate of magnesia with some phosphate of lime. The organic substance combined with it contained nitrogen, but no sulphur that could be detected in it by potash and a salt of lead.

The liquid filtered from the precipitate contains two products of decomposition of emulsine, one of which, forming about a fourth of the quantity originally employed, is not precipitated by alcohol; whilst the other, constituting about thirty per cent., separates upon the addition of strong alcohol in the form of a white granular precipitate. Washed with alcohol and ether and dried, this precipitate forms a white, opaque, tenacious mass, which is difficult to powder, and contains a large, although variable, amount of the above salts of phosphoric acid. Several experiments furnished from eighteen to thirty-five per cent. of ash. The analyses gave the following results, according to which the substance differs essentially from emulsine:—

Carbon	43.17	43.11	42.48
Hydrogen	6.85	6.73	7.02
Nitrogen	8.62	8.34	8.48
Oxygen and sulphur	41.36	41.82	42.02

Acetate of lead separates this substance into two others, one of which contains sulphur, the other none. To the aqueous solution of the fresh precipitate obtained by alcohol, acetate of lead was added as long as a precipitate resulted; this was suspended in water, decomposed by sulphuretted hydrogen gas, and the excess of sulphuretted hydrogen expelled at a gentle heat. The filtered liquid had a strong acid reaction, which arose partly from phosphoric acid, partly from an organic substance. Upon concentration it formed a syrupy mass, which was decomposed by potash, with evolution of ammonia, and with a salt of lead it showed the presence of sulphur.

The liquid filtered from the precipitate obtained by acetate of lead furnished, after removing the lead and the acetic acid, on evaporation, a neutral gummy mass, readily soluble in water, and which yielded a jelly with a solution of caustic potash. It contained nitrogen, but no sulphur.

Unboiled emulsine is so completely precipitated from its solution by neutral acetate of lead, that the filtered liquid no longer furnishes oil of bitter almonds with amygdaline, whilst the lead precipitate retains this reaction.

A solution of emulsine begins in the course of four or five days, by exposure to the air at the ordinary temperature, to be decomposed with evolution of gas; it becomes turbid; gives with neutral acetate of lead, but not with acetic acid, a copious precipitate, and still retains for some time the reaction with amygdaline.

A solution of emulsine, which has been freed from the phosphates by neutralization with lime-water, yields with neutral acetate of lead a thick precipitate. This was decomposed with sulphuretted hydrogen. After filtration and removal of the excess of sulphuretted hydrogen at a gentle heat, an acid liquid was obtained, which left, on evaporation, an acid gummy mass containing nitrogen. It was insoluble in alcohol and ether; it formed with baryta and silver insoluble, with magnesia soluble, salts.

The liquid filtered from the precipitate with acetate of lead left on evaporation, after removing the sulphuretted hydrogen and acetic acid, a gummy nitrogenous mass.

On distilling the alcohol, which had served to precipitate the emulsine, the liquid acquired a dark colour, and left on concentration an acid mass, the acid in which proved to be lactic acid.

The precipitate obtained with acetic acid previous to the precipitation of emulsine by alcohol formed, after it had been freed from fat by exhaustion with alcohol and ether, a reddish fine light powder, soluble in alkalis; but, on warming the solution, it is decomposed, with disengagement of ammonia. This substance is not precipitated from its alkaline solution by alcohol; it is, moreover, soluble in weak, and only partially soluble in concentrated, acetic acid. It contains nitrogen and sulphur, and burns with a smoky flame, leaving a small quantity of neutral ash. It dissolves in strong muriatic acid into a beautiful red liquid, which colour changes into a dark purple in the course of one or two days. It gelatinizes in sulphuric acid, and changes, with evolution of sulphurous acid, from red into black. On analysis it was found to contain 51.02 per cent. carbon, 6.87 hydrogen, 15.80 nitrogen, 25.74 oxygen, and 0.57 sulphur. The relation of nitrogen to carbon is as 1 to $7\frac{1}{2}$.

In the maceration of recently-pounded almonds with ordinary alcohol, grape-sugar was extracted, which was obtained by means of water from the residue remaining on evaporating the alcohol.

When an emulsion of almonds, prepared as above directed, is allowed to ferment for some days at about 86°, an oily coagulum separates, and the subjacent liquid becomes more and more sour. This acidification has great resemblance to the becoming sour of ordinary milk. The conversion of the sugar into lactic acid, and the union of this acid with the bases which held the caseous substance in solution, explain the separation of this coagulum and the absence of any precipitate with acetic acid, as soon as a sufficient quantity of lactic acid has been formed to separate the caseous substance from its combination with the alkalis.

Emulsine loses the property of decomposing amygdaline into oil of bitter almonds and prussic acid when its solution has been boiled, which is not the case when it is exposed in the dry state to a temperature of 212°.

It was found very difficult to obtain the substance in a pure state fit for analysis, on which account the results do not agree very accurately with one another; however, so much is evident from the analyses, that the emulsine precipitated by alcohol has a definite composition. The materials used for the following six analyses were prepared at different times. I. to IV. were dried for several days at 212°. For No. V. a fresh emulsion of almonds was first mixed with ether to dissolve the oil, and then set aside for two or three days in a closely-stoppered vessel until the mixture had separated into two parts; the upper stratum was a thick, opaque, somewhat gelatinous mass, and consisted of a solution of the oil in ether; the subjacent aqueous liquid was filtered, and immediately precipitated by alcohol. The emulsine prepared in this manner does not differ essentially in its composition from the others, as will be seen by the following numbers. VI. was prepared like I. to IV., but dried at 266°:—

	I.	II.	III.	IV.	V.	
Carbon	43.59	43.74	42.75	42.09	43.08	43.15
Hydrogen	6.96	7.33	7.37	7.34	6.81	7.39
Nitrogen.	11.64	11.40	11.52	11.52	11.52	11.52
Sulphur	1.25	37.53	38.36	39.05	38.59	37.94
Oxygen.	36.56					

The formula $C^9 H^9 NO^6$ would correspond to these numbers; and, if the amount of sulphur were likewise considered essential, it would be $10(C^9 H^9 NO^6)+S$. — *Liebig's Annalen*, lxix., p. 145.

ON THE CONSTITUTION OF THE BASIC NITRATE OF BISMUTH.

By H. BECKER.

As different statements exist with respect to the composition of the Magisterium bismuthi, the author has been induced to make it the subject of fresh investigation.

The salt which separates immediately on mixing neutral nitrate of bismuth with water in the cold always possesses, according to the author, the same properties and the same composition whether a crystallized salt of bismuth has been used or a very acid solution. The precipitate which is produced by the addition of metallic bismuth to a concentrated solution of the nitrate is likewise identical with this basic salt. It always contains, as stated by Dulk, 1 equiv. of oxide of bismuth, 1 equiv. nitric acid, and 2 equivs. water. The analyses, in which the oxide of bismuth and the nitric acid were determined directly and the water calculated from the loss, furnished:—

Oxide of bismuth	77.33	77.51	77.47	1=76.65
Nitric acid	17.20	17.23	17.09	1=17.53
Water	5.47	5.26	5.44	2= 5.82

At 212° this salt loses, as stated by Heintz, half its water.

When recently precipitated, this salt is dissolved in considerable quantity by water, especially if it contain nitric acid. If, therefore, after precipitating the basic salt, the liquid is mixed with a considerable amount of water, the precipitate is entirely redissolved; but after some time, which varies with the quantity of acid and the temperature, a basic salt separates. If the solution contain free nitric acid and the water added was cold, the compound $5BiO_3 + 4NO_5 + 9$ aq is formed, which, according to Becker, is the real Magisterium bismuthi; as even by the original prescription, according to which the precipitate formed in an acid solution of bismuth upon the addition of water should be washed on the filter with water, the same salt is obtained, this change occurring on the filter with loss of acid; in this operation, however, a portion of the precipitate dissolves, and separates again from the filtered liquid after standing for some time. The decrease in the precipitate during the washing is owing more to the circumstance that the precipitated salt with 1 atom of acid forms extremely delicate and light laminæ, whilst the Magisterium consists of thick short prisms. To prepare the basic nitrate, therefore, without any loss, it is advisable not to wash the precipitate produced by water upon the filter, but to decant the acid solution and then add a quantity of water. Its composition is:—

	Found.		Herberger.	
Oxide of bismuth	79.85	80.18	79.7	5=79.91
Nitric acid	14.52	14.58	14.4	4=14.62
Water	5.63	5.26	5.9	9= 5.47

As is seen, the analysis of Herberger agrees with this formula, although he deduces from it the formula $4BiO_3$, $3NO_5$, 9HO.

Magisterium bismuthi does not dissolve perceptibly in cold water; it is, however, deprived of acid and a little oxide of bismuth; hot water changes it into a dirty white heavy powder. The power which remained after long ebullition still contained one per cent. of nitric acid, which could not be completely removed by water.

The same proportion of acid and base, but with more water, was found in a salt, which separated, on evaporating a concentrated solution of bismuth at a high temperature, in white crystalline crusts, which on pressure between paper crumbled to a shining, crystalline, very hard powder. Its composition is:—

Oxide of bismuth	78.49	5=78.48
Nitric acid	13.96	4=14.36
Water	7.55	12= 7.16

The products which are obtained from the first precipitated salt with one atom of acid by a different treatment are quite distinct from the above. When, for instance, it is heated with water in the presence of free acid, or an acid solution of bismuth is poured into hot water, a white, very loose powder is obtained, which is decomposed more rapidly by water than the basic nitrate, and possesses the following composition:—

Oxide of bismuth	80.19	80.29	6=80.16
Nitric acid	15.62	15.24	5=15.27
Water*	4.19	4.47	9= 4.57

If this salt is washed with water until what passes through has no longer a strong acid reaction, the residue consists of prisms of far greater size; and when dry forms a heavy dirty white powder, which possesses the formula $4BiO_3$, $3NO_5$+9HO, and is, consequently, identical with the Magisterium bismuthi prepared according to Duflos's process.

* The composition of this precipitate differs evidently very slightly from that of the Magisterium bismuthi, and this may possibly be owing to the length of the washing.

Lastly, when the salt with one atom of acid, freed from all adherent acid liquor, is treated with pure water, it dissolves almost entirely. After a short time a milky liquid is obtained, from which, in the course of time, a white amorphous powder is deposited, which is represented by the formula $5BiO_3$, $3NO_5$, 8HO. This salt may be formed, together with Magisterium bismuthi, when too much water is used, and the acid liquor is for the greater part removed.—*Liebig's Annalen*, lxviii., p. 282.

SOME OBSERVATIONS ON CHLOROFORM.

By Messrs. SOUBEIRAN and MIALHE.

Two liquids are sold in commerce under the name of chloroform, which, although of very different origin, have nevertheless been hitherto considered as identical, and substituted one for the other. However, they exhibit some remarkable differences in their properties; the one, derived from the action of hypochlorite of lime upon alcohol, possesses all the characters which have been assigned by one of us to chloroform, and which we shall therefore call normal chloroform; the other, obtained by the action of hypochlorite of lime on pyroxylic spirit or methylic alcohol, differs so much from the first that we were induced to submit them to a careful comparative examination to ascertain the cause of this difference.

The chloroform from pyroxylic spirit, which we shall call for convenience methylic chloroform, although possessing the same physical appearances as the normal chloroform, has quite a different odour; it is not sweet and agreeable, but empyreumatic and nauseous. Its density is less than that of ordinary chloroform; the latter weighs 1.496, whilst the specific gravity of the former is only 1.413.* Its boiling point likewise appears to be lower; and lastly, the inhalation of the methylic chloroform, far from being agreeable and pleasant, produces a general feeling of sickness, followed by a heaviness in the head, and sometimes by vomiting.

These differences led us to believe that they did not possess the same composition, or that the properties of one of them were masked by some foreign substance. On the first hypothesis, it might be imagined that the chloroform, which does not belong to the same chemical type as alcohol, and which is produced by the profound disturbance caused by the action of chloride of lime, might prove to be a different substance according as it resulted from the action upon alcohol, which belongs to the ethylic series, or from the reaction on wood-spirit, which belongs to the methylic series. It might also happen that the difference was owing to a weaker or stronger condensation of the methyle, supposed to exist equally in the two chloroforms. To decide this we undertook some analyses, the result of which will be given subsequently. The second hypothesis supposes the identity of the chloroform, whether it has been formed from alcohol or from pyroxylic spirit; the difference in this case would arise from the presence of a foreign substance. This opinion is better founded; in fact, on attempting to rectify methylic chloroform by successive distillations over chloride of calcium, we found that the salt forming the residue retained after each distillation a certain quantity of a peculiar oil, which was easily isolated by washing with water. By repeated rectification we were able to obtain a considerable amount of this oil, the proportion of which rose to as much as 30 grms. in 500 in some commercial chloroforms.

This new substance is liquid and of an oily consistence. At first yellowish, it is rendered colourless by a simple rectification; it has a very peculiar and very strong empyreumatic odour, similar to that possessed by the methylic chloroform; it is lighter than water; it began to distil at 185°, but gradually rose to 271°. This rise of temperature during the distillation evidently indicates a mixture of different compounds. It readily took fire, and burnt with a very intensely smoky flame. The presence of chlorine among the products of its combustion indicated that this body formed a constituent part.

Although rectified several times, the chloroform which had yielded this oil still retained the characteristic empyreumatic odour. We therefore sought for some chemical reagent which, without acting upon the chloroform itself, should either separate or destroy the oil it still contained. After some experiments, concentrated sulphuric acid appeared to us most suitable; it produced in the impure chloroform a brownish-red colour, which was the more intense the more oil was contained in the mixture. This colour, which it likewise produces in a far higher degree with the isolated oil, is due to its carbonization; so that, on distilling impure chloroform with a certain quantity of concentrated acid, we succeeded in obtaining a product which was no longer coloured by this powerful reagent, and possessed no empyreumatic odour.

We were then able to analyze the chloroform thus purified, and to examine its properties compared with those of normal chloroform. Composition, boiling point, density in the liquid state and in the state of vapour, were all found to be perfectly alike; and we were able to assure ourselves that there exists but one chloroform, and that that derived from wood-spirit does not differ in the least from the chloroform from alcohol when the precaution has been taken to separate the whole of the oil above mentioned. However, it must be stated that the complete separation of this oil was not effected; there still remained a minute proportion, so small indeed as to have no influence either on the specific gravity or on the results of the analysis; but it was evident, from the odour which remained after evaporating a sufficiently large quantity of chloroform, and likewise the vessel used to take the density of the vapour still perceptibly retained the peculiar odour of this chlorinated methylic oil. It is almost impossible to remove the last traces of it; they resist the action of concentrated sulphuric acid even after long-continued contact.

There are, therefore, not two kinds of chloroform; but the presence of a peculiar oil, produced in the action of chloride of lime upon pyroxylic spirit, is the cause of the differences which they present at first sight. Having established this fact, we now inquired whether during the preparation of chloroform from alcohol a substance analogous to that just described was not produced. Our suppositions were confirmed by experiment. The crude chloroform was first washed with water, then with carbonate of soda, left for a long time with chloride of calcium to remove the water; and, lastly, filtered and distilled in a glass retort in a water-bath. There remained in the retort an aromatic liquid, but of an odour different from that of chloroform; but the amount was very small, being not 40 grms. from 20 kilogrammes of chloroform.

This oil differs essentially from that obtained from the chloroform prepared with pyroxylic spirit; it is heavier than water, and has a peculiar acrid penetrating odour, totally different from that of the other. On attempting to determine its boiling point, we found that, like the former, it consisted of a mixture of different compounds; for the thermometer, which stood at 154° at the commencement of the ebullition, rose to 243°, and the temperature would undoubtedly have risen still higher had a larger amount been at our disposal. All these compounds contain chlorine, as was evident from an examination of the products of their combustion. Although these different substances were not submitted to analysis, everything leads us to believe that they are intermediate in composition between chloroform and one of the known chlorides of carbon.

It is scarcely possible to decide by what reaction these chlorinated oils are produced, no organic analysis having been made; we may, however, observe, that in the preparation of chloroform from ordinary alcohol the more chlorinated oil is formed the less chloride of lime is added to the mixture, or that the production of the substance is due to an excess of chlorine.

It results from what precedes that the chloroform obtained from wood-spirit should not be employed for inhalation, it being impossible to deprive it entirely of its empyreumatic odour; it might be used for liniments, after having been previously rectified over sulphuric acid and chloride of calcium; but the necessity of these rectifications destroys the advantage which might arise from the substitution of pyroxylic spirit for alcohol.

The presence of the chlorinated oil, however small in quantity, even in the chloroform obtained from alcohol, has a very decided influence on the use of this substance. It is to it that must be most frequently attributed the sickness and vomitings caused by the inhalation of chloroform. It is therefore absolutely requisite to distil the chloroform, in order to separate the foreign substance which it contains; and this distillation should be stopped shortly before the end of the operation, in order not to re-form the mixture. The oil contained in the residue then possesses in the highest degree the property of producing headache and giddiness; its action upon the system certainly requires that its physiological effects should be studied.

In conclusion we may draw attention to a physical property of chloroform, which appears not to have been previously noticed; it is its solidification by spontaneous evaporation. When chloroform is poured upon a double filter of bibulous paper, a great portion of the liquid, from its heaviness and fluidity, quickly passes through the paper; whilst another portion, evaporating rapidly upon the margins of the filter, produces so much cold as to congeal it into white silky scales, which keep a few instants.—*Journ. de Pharm.*, and *Chem. Gaz.*

* We may observe that the density of chloroform, fixed by M. Liebig at 1.480, is too low; we have constantly obtained 1.496 at 54° for a perfectly pure chloroform. This difference undoubtedly arises from the presence of a foreign substance which had not been separated from the chloroform, as we shall presently show.

ROYAL COLLEGE OF SURGEONS.—The following gentlemen, having undergone the necessary examination for the fellowship of this institution, in pursuance of the charter granted to the college, were admitted fellows at the meeting of the president, vice-presidents, and council on the 16th inst.:—Messrs. Samuel Allen Hindley, Birmingham; Peter Lodwig Burchell, Kingsland-road, diploma dated July 5, 1839; Edward Dennis Hacon, Hackney, July 3, 1840; Edward Law Hussey, Oxford, February 7, 1845; Henry Thomas Leigh, Turnham-green, Middlesex, February 13, 1829; Thomas Littleton, Saltash, Cornwall, May 7, 1847; John Morgan, Albion-place, Hyde-park-square, April 30, 1841; Edward Palmer, Westminster; George Hill Smith, Hertfordshire, November 17, 1837; and Frederick Wildbore, Ealing, Middlesex, late house surgeon to the Westminster Hospital, April 7, 1843. The following gentlemen, having undergone the necessary examinations for the diploma, were admitted members of the college at the meeting of the court of examiners on the 15th inst.:—Messrs. Cecil Crandell, Royal Navy; Basil Eyston, Birmingham; William Weaver Jones, Cleobury Mortimer, Salop; George Smith, Stroud, Gloucestershire; Thomas Collyns Blanchard, Southampton; Edward Rutley Ray, Milton, near Sittingbourne; Thomas Peregrine James, Abergavenny, Monmouthshire; Thomas Wallscourt Blake Greaves, Tuam, Galway; James Breach, Bradfield, Berkshire; Henry Benjamin Lillie, Colchester; Richard Lee, Thame, Oxfordshire; and William Strong Browne, Camberwell.

Frederick William Bodmer, of Paris, civil engineer, for certain improvements in machinery or apparatus for letterpress printing. Patent dated August 16, 1849; six months.

STATEMENT IN CONTINUATION OF THE ONE PUBLISHED IN THE CHEMICAL TIMES OF AUGUST 18, 1849, SHOWING THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE AIR FROM AUG. 12 TO AUG. 18 INCLUSIVE, AS INDICATED BY THE EVAPORATION OF WATER FROM TWO COPPER VESSELS OR SCALES, ONE INSULATED AND THE OTHER NOT. ALSO THE READING OF THE BAROMETER, THERMOMETER, DIRECTION OF WIND, AND GENERAL STATE OF THE WEATHER.

Aug., 1849.	Barometer.		Therm.		Scales.				Wind.		General State of Weather.
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Insulated	Non-Insulated	Morning.	Evening.	
12	29.80	29.70	69	65	5 N.	10 I.	10	5	W.	SW.	Two showers, but generally fine all day; the clouds were most magnificent, and of every hue from black to white.
13	29.65	29.60	66	62	20 I.	15 I.	35	..	SW.	SW.	Several showers during the day, but bright sunshine between them.
14	29.68	29.75	62	63	..	20 I.	20	..	W.	W.	One shower at six P.M., but fine all the rest of the day.
15	29.85	29.95	63	62	5 I.	10 I.	15	..	W.	W.	Fine all day.
16	29.78	29.80	64	59	..	15 I.	15	..	SW.	SW.	Generally overcast all day.
17	29.85	29.93	62	61	10 N.	5 I.	5	10	W.	W.	A shower at five P.M.; fine rest of the day.
18	30.00	30.03	58	58	..	15 N.	..	15	N.W.	NW.	Shower at two P.M.; fine rest of the day.

It will be seen that the electrical condition of the air was good from the 12th to the 16th inclusive: it, however, decreased on the 17th and 18th, with a rising mercury; but the wind went round to the east of north, a change my apparatus generally indicates, as well as change in the weather. The cholera appears to be on the decrease in this district, but other parts of the metropolis are not equally favoured; in them, however, no register of the relative electrical state of the air and the earth is kept.

Westminster-road, Aug. 20, 1849.

Franklin Coxworthy, Author of "Electrical Condition," &c.

FRANKLIN COXWORTHY'S DISCOVERIES IN NATURAL PHILOSOPHY.

[*Continued from page* 127.]

In controversion of the assumptive doctrine of the diffusion of gases, we have shown that it is at variance with the universal law of gravitation—that, when closely investigated, it does not account for the restoration to the atmosphere of the gases disengaged from it during combustion and respiration—and that, if under the influence of the assumption we contemplate such of the other phenomena of nature as the restoration to the earth of the carburetted hydrogen evolved by the decomposition of vegetable matter, "chaos is come again." But strong as may be considered the evidence we have already adduced—decided as may be the *argumentum ad absurdam* to which we have reduced the doctrinaries of "diffusion"—there is another fact to which we will refer, of itself sufficient to overthrow the fallacy.

Liebig, and other chemical savans, long since determined, by actual experiment, that ammonia is invariably contained in both rain and snow water; and, admittedly without sufficient examination, accounted for its presence by assuming that the ammonia must be collected from the air by the rain and snow in their passage from the upper regions; and by which the atmosphere became purified of this gas, liberated or diffused into the air during the decomposition or putrefaction of matter—although matter does not putrify during that low state of the temperature in which snow reaches the earth. But, as far as we have been enabled to trace, neither Liebig nor any other of those who have concurred with him had been satisfied by actual experiment that the water precipitated at the termination of a shower or storm contained the same proportion of ammonia as that which fell at the commencement. The importance of such an experiment had been frequently alluded to, and its necessity thence inferred. If, for instance, at the conclusion of a fall of rain of some hours' duration, a palpable difference could be found in the quantity of ammonia held in solution, the theory—to that extent only—might be worthy of further examination. And if not, as we confidently believe to be the case, neither suffusion nor infusion will prevent the utter demolition of indoctrinal "diffusion."

On a subject of so much interest we are astonished that Liebig, at least, did not bestow the indispensable examination of experiment. He was bound to prove an affirmative assumption of such extreme importance, especially as it was offered in corroboration of another assumption. We are satisfied that both are equally groundless.

Our readers will be aware that it is to the ammonia, held in solution, that rain water is indebted for its peculiar softness, for a semi-saponaceous smoothness of feeling when we lave our hands in it—for its application to domestic purposes to which other water cannot be so usefully applied without the addition of ammonia, or some other softening material. Ammonia, indeed, is excessively soluble in water; and it is evident that the rain, after showers of considerable duration, if Liebig were correct, could obtain no ammonia from an atmosphere already deprived of it by preceding showers. And, by the same rule, showers falling at long intervals ought to be laden with infinitely larger proportions of ammonia than those pouring down continuously sometimes for days and nights together!

In the absence, then, of any evidence on the part of Liebig to sustain his hypothesis, we cannot do otherwise than accept the testimony of Franklin Coxworthy to the contrary; albeit he has not had the requisite appliances to prove the negative in the most conclusive form—actual analysis. As far, however, as taste and colour, and lavements and other manipulative applications, could be carried by him, repeatedly and most attentively, he declares that he can discover no difference whatever in the essential properties of rain water, caught at the commencement or conclusion of showers of varied durations, in any season,—a fact which is to the same extent discoverable by any of our readers.

Thus an assumption arrived at by those who concurrently admit that its proof is important, has not been proved by them, or, as far as we can learn, by others, is denied on the basis of inductive reasoning as being an improbable adjunct to an impossible hypothesis; and that denial is supported by the best attainable experiments.

Now, no such fallacies as those we have been endeavouring to dissipate are necessary to the doctrine propounded by Franklin Coxworthy, of which we have already given the premises. He assigns to the formation of snow the combination, in the upper regions, of the gases of vapour (oxygen and hydrogen), the nitrogen liberated by combustion and respiration, and the carburetted hydrogen evolved by the decomposition of vegetable matter. And, as previously stated, the fuel consumed in this country, annually, is alone equal to the liberation from the atmosphere of about 380,000,000 tons of nitrogen; and as, by the conversion of this gas into ammonia, it combines with about one fifth of its weight of hydrogen, we have thus formed about 456,000,000 tons of ammonia.

Concluding this portion of the subject, we have to observe that the habitable world contains about 1,000,000,000 of human beings, a large proportion of whom are located in latitudes wherein the consumption of great quantities of fuel is necessary for the production of artificial heat; and in all latitudes fuel is requisite for household and manufacturing purposes. If, therefore, twenty-eight only out of this thousand millions liberate from the atmosphere, through the use of fuel alone, a quantity of nitrogen equal to the generation of about 456,000,000 tons of ammonia, there can be no difficulty in comprehending that the general use of fuel, accidental conflagrations, artificial lights, the explosion of "villanous gunpowder," volcanic irruptions, &c., added to the constant respiration and other animal functions of the myriads of warm-blooded creatures, biped and quadruped, should generate ammonia to an extent equal to what may be brought down in the rain upon the entire surface of the globe; assuming that every drop contained its due proportion. Believing this, we need not suppose that, as "the early bird catches the worm," so the early shower must catch the ammonia! Or that nature shall so vary her laws that some showers shall but partially or not at all perform the functions assigned to them, but, defrauded of their fair share of ammonia, be allowed to descend unfructifying to the earth, or otherwise less personally useful to mankind!

We shall return to this subject in our next.

Gutta Percha Boat.—A beautiful outrigger, 45 feet long, constructed of gutta percha, has been launched at York by Mr. Demain, a young and ingenious mechanic. The lightness of the boat and its perfect security from leakage are remarkable. The gutta percha answers so well that five others of a similar size are in the course of being built. The perfectly waterproof qualities of this novel material seem to render it an article of peculiar value, not only as shoe soles, but for numerous nautical purposes.

Apothecaries'-hall.—The following are the names of the gentlemen who passed their examination in the science and practice of medicine, and received certificates to practise, on Thursday, the 16th of August:—William Clapham Cautley, Hedon-hall; Thomas Brutton Kenderdine, Stafford; Thomas Edis; William Bellhouse Midwood, Manchester; John Adams Palin, Francis Henry Vertue.

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THE CHEMICAL TIMES.

SATURDAY, AUGUST 25, 1849.

THE CHOLERA AND THE DOCTORS.

SEVERAL months ago we ventured to assert that the distemper which at that time prevailed in some parts of the metropolis did not deserve the name of "Asiatic cholera," which was so freely bestowed upon it by the medical profession. At the same time we expressed our apprehension that the *true* Asiatic cholera would shortly make its appearance on our shores, and, by the numbers, virulence, and fatality of its attacks, demonstrate the correctness of our opinion of the real nature of its precursor. We also maintained that the more aristocratic quarters of London would not escape the visitation of the scourge, and that all the sanitary and sanatory measures adopted or recommended by the Board of Health would prove but feeble barriers to its progress.

Our apprehensions have been but too fully realized by the events of the last few weeks. The Registrar-General's report for the week ending the 18th instant shows the formidable number of 1,230 deaths from cholera, which,—and this is still more serious,—marks an increase of fifty per cent. upon the deaths from the same cause registered the week before last; and, according to present appearances, this increase will continue this week in about the same ratio.

But what we view with greater and graver apprehension still than even this rapid increase in the absolute number of deaths from cholera is the large proportion which the fatal cases bear to the number of attacks. In the last few days this proportion has exceeded fifty per cent.—in other terms, one out of every two cases has proved fatal. When we take into consideration the fact that *many* of the *recoveries* are set down as cholera cases which might, probably, much more aptly be termed simple attacks of diarrhœa, we have surely ample reason to doubt the efficiency of *any* of the thousand and one methods and nostrums that we see daily and weekly trumpeted forth in the columns of the press as "*infallible in most cases.*" The fact is, the nature and proper treatment of this mysterious disease are just as little or even *less* known *now* than they were at the time of its first invasion: hence the miserable experimentalism which we see so unblushingly resorted to by medical practitioners—the *trying of all* and *everything* in the wide range of the Pharmacopœia, in the hope of stumbling accidentally upon *something* that may do good;—and hence also, as the natural consequence of this wild and most irrational empiricism, the enormous proportion which the fatal cases bear to the number of attacks. Yes, we repeat it, the large proportion which the number of deaths bears to that of attacks is, in our opinion, owing in a great measure to the *interference* of the physician with the operations of nature, which, if left to herself, would probably save seven out of ten, whereas now only four to five out of ten recover.

In another part of our columns will be found a report of the proceedings of a meeting held on Thursday, the 16th inst., at the Literary Institution, Borough-road, Southwark, by the gentlemen constituting the South London Medical Society—a meeting held for the avowed purpose of discussing the nature and treatment of the prevailing epidemic, but which occupied itself instead with a most unprofitable, and, in the present state of affairs, deplorable, discussion on the vexed question of contagiousness or non-contagiousness, some of the gentlemen present holding out stoutly for the contagion theory upon the most inconclusive, nay, upon the most trivial, grounds that could possibly be adduced. With respect to the *nature* and *proper treatment* of the disorder, the whole of the gentlemen who attended the meeting confessed themselves equally abroad, one of them very naïvely remarking that he knew only *what remedies did no harm (!)*, but was thoroughly ignorant of any certain means of cure. And, pray, Dr. Murphy, will you kindly tell us what are the remedies that do no harm? How do you know whether your "innocent" calomel, opium, camphor, &c., may not after all *do* harm, when administered to a patient labouring under a fierce attack of cholera? Another gentleman, Dr. Rees, stated that he "had had a great deal of experience (?) of cholera in the Bermondsey workhouse, but he was free to confess that, although he had seen a very great deal, he knew very little of it. He had tried several plans, and he did not believe any one possessed any advantage over the other" (which, properly interpreted, means simply that they proved all equally unavailing). "He had tried the application of cold water to the surface; he had tried charcoal, and also carbonic acid. The calomel and opium treatment had also been tried freely, *and he was now trying the bichloride of mercury (!)*; but so far as he had seen no single plan showed any great advantage over any other." Now for the principle upon which bichloride of mercury, for instance, has been *tried* by Dr. Rees. Why, that gentleman informs us that we have to look for the cause of cholera to some *animal poison*, and that accordingly the most effective remedies will be those that will combine with animal poison, such as bichloride of mercury, arsenic, creosote, tannin, &c. So that, in all probability, the Bermondsey paupers who are unfortunate enough to catch the cholera will be treated next to a *trial* with arsenic. Right, Dr. Rees; go on experimenting. You are placed in a most favourable position for it:—Fiat experimentum in corpore vili.

But, gentlemen, all of you who deem this species of random medication of those whom Providence has smitten with the choleraic scourge fair or even permissible may we venture to ask you, whether it would not be better that you should endeavour, in the first place, to study and fathom the *nature* of the disease, the *cause* of the effects, before you embark upon a purely speculative treatment, and upon futile attempts to combat its symptoms? It is from these symptoms alone that you can possibly expect to learn the nature and character of the foe whom you have to encounter; and do you not by your medication, which, as you yourselves confess, is *worse* than useless,* grievously interfere with the free manifestation of these symptoms? You cannot tell whether such or such a symptom which you may happen to observe in a case of cholera is referable to the disease or to the action of the medicinal agent which you may have deemed proper to administer. The language of the symptoms, usually so plain and intelligible to the practised eye and mind of the experienced and skilful physician, is thus rendered ambiguous and obscure; and every step which you make seemingly in advance in your fancied appreciation of the true character of the foe with whom you have to deal serves in the end only to perplex you more and more.

In our humble opinion the careful and most attentive watching of a few cases of cholera in patients of powerful constitution, without any attempt at interference with the operations of nature on the part of the physician, would do more to dispel the mystery which hangs over that dire disease, and to lead to a rational and effective mode of treatment, than all the random medication in the world.

FIFTH NOTIFICATION FROM THE GENERAL BOARD OF HEALTH.

The prevalence of Asiatic cholera in the metropolis, and in England generally, up to June, was limited to comparatively few localities, beyond which it did not spread; but its outbreak, wherever it appeared, was generally violent, the proportion of the deaths to the attacks being very great, and, in some instances, as in the establishment at Tooting, in several lunatic asylums, and in some workhouses and prisons, the numbers seized were so large as to indicate a true epidemic tendency. In other countries, though it appears that the pestilence has created less alarm, it has spread more extensively and been more fatal than on its former visitation; and since the middle of June its progress in England and Wales has proved that here also the epidemic force is greater than it was in 1832.

Notwithstanding the representations addressed to the local authorities charged with carrying out the regulations made under the authority of the Legislature for preventing the localization and spread of epidemic diseases, that the seats and subjects of cholera and the seats and subjects of typhus are generally the same, in almost every instance where attacks have been made in groups of cases it has been found that the preventive measures enjoined by the General Board of Health in November last had not been commenced until after the actual outbreak of the disease.

Yet had the preventive measures, founded on the provisions of the Nuisances Removal and the Diseases Prevention Act, been carried into effect without delay, and to the greatest practicable extent, there would still have remained in many localities sanitary evils of the greatest magnitude, wholly irremovable under this act, and for which the only remedy is the Public Health Act. In the instances, however, in

* Dr. Barlow, one of the gentlemen present at the meeting, stated that "in the *worst* cases that he had seen, *where recovery had followed, little or nothing had been done.*"

which the cleansings, the removal of nuisances, and the other preventive measures authorized and required by the former act have been enforced, the results have been proportionately beneficial.

Wherever the disease has spread extensively through any district, or has been localized in a court or street, or has appeared in groups in the same dwelling, the inspectors on examining the locality have uniformly reported the existence of filth, bad ventilation, overcrowding, and other local causes of atmospheric impurity.

And whenever, by intelligence and energy, these localizing conditions have been changed, particularly when under the direction of an inspector, the further regulations enjoining the special preventive measures of house to house visitation, and immediate treatment of the premonitory symptoms, have been faithfully carried out, the pestilence has been checked, and in some instances it has been abruptly and finally terminated in the course of a few days; but, on the other hand, in several instances when, after the departure of the inspector, the house to house visitation has been suspended, and when, consequently, the early detection and treatment of the premonitory cases have been no longer possible, the disease has again broken out with renewed force.

From the report of the General Board of Health recently presented "On the measures adopted for the execution of the Nuisances Removal and Diseases Prevention Act, and the Public Health Act, up to July, 1849," it appears that bad sanitary conditions have in numerous instances localized the epidemic to such an extent that, alike in cities, towns, and villages, almost the entire population have been simultaneously affected with the premonitory symptoms of the disease. In these instances, until the house to house visitation has been systematically and energetically carried out, great numbers of the premonitory cases have continued to pass into the developed and fatal stage; but as soon as by this agency the disease has been detected where it was seerctly forming, and has been immediately placed under treatment, its progress has been arrested, so that it has seldom gone on to developed cholera. Thus, in one instance, out of 13,089 premonitory cases discovered by the system of house to house visitation, and reported as having been placed under treatment, only 80 are stated to have passed into cholera. In another instance not a single death occurred out of 1,380 cases of premonitory diarrhœa brought under early treatment; but when diarrhœa has been neglected until vomiting has come on the mortality has risen to 7 per cent., and has increased progressively, according to the length of delay, to 39 per cent.; while instances in which it has not been brought under treatment until the evacuations have become serious, and have been accompanied with cramps, 53 persons have died out of every 100;—facts which, it has been justly stated, establish the unity of the disease and its progressive danger.

There is, indeed, undoubted evidence that occasionally individuals are attacked quite suddenly without any previous warning; but this almost always occurs only on the first outbreak of the disease in a locality, and happens chiefly to those who are living under peculiarly bad sanitary conditions, or are of intemperate habits. In the great majority of instances distinct warning of the approach of the disease in time for the adoption of effectual remedies is given.

Proceeding on these results of experience, the General Board of Health have deemed it their duty to enforce, as far as was within their power, the observance of the regulation enjoining house to house visitation, satisfied that it is the means of saving life, and that the cost of carrying it into effect is incomparably less than that which must otherwise be incurred for the mitigation of sickness and the support of the permanent pauperism occasioned by orphanage and widowhood.

There are, however, houses and localities in which the predisposing and localizing conditions exist in such intensity that until their sanitary state is wholly changed no measures will succeed in preventing the development of the disease. In these cases the only remedy is the dispersion of the inhabitants, and the removal of the destitute to houses of refuge until their own abodes are cleansed and purified according to regulation No. 15, issued in November last.

Seeing the continued progress of the disease and its extension to numerous new localities which appeared to have escaped during the visitation of 1832, the General Board of Health again earnestly repeat the cautions given in their first and second notification with reference to diet, clothing, and the general means of maintaining health and vigour. For reasons already fully stated, the articles of food, where there are the means of choice, should be solid, nutritious, invigorating, and concentrated, tending to maintain moderately costive bowels—a state which experience has shown to be more conducive to exemption from cholera than an opposite habit. Great care and due moderation in food and drink are essential to safety during the whole duration of the epidemic period. Particular attention should be paid to the avoidance of cold and damp, and to maintaining the sitting and bed rooms well aired, dry, and warm. Every day's experience shows the urgent necessity of instant attention to the slightest degree of diarrhœa. At a time when there is the danger that looseness of the bowels may be the commencement of such a disease as Asiatic cholera a due regard to his own safety should induce every one having this premonitory symptom to apply without delay for medical assistance; but an attack may come on in the night, or under circumstances in which medical assistance cannot be promptly obtained; in this case life may depend on having proper medicine at hand to be administered at once. In places in which the pestilence has been recently prevailing great advantage is stated to have arisen from following the recommendation given in a former notification to place proper medicine in the custody of the heads of families, the masters of schools and workhouses, the owners or overseers of large establishments and manufactories, clergymen, and other intelligent persons; but such medicine should be simple in its nature, and administered only at times and under circumstances when medical assistance cannot be promptly procured. Experience appears to have suggested no better form of medicine to be given under these circumstances than that formerly recommended, viz., for an adult, from ten to twenty grains of the confection of opium, mixed with two tablespoonfuls of peppermint-water, or with a little weak brandy and water; or a draught composed of one ounce of chalk mixture, with ten or fifteen grains of the aromatic confection, from five to ten drops of laudanum, and from half a drachm to a drachm of tincture of catechu. Such a dose should be taken when there is any degree of relaxation of the bowels, or when there are more than two stools in the twenty-four hours.

But these medicines are recommended only when medical assistance cannot be procured at once; and in all cases, wherever practicable, even in the very earliest stage of the disease, recourse should be had to medical advice on the spot. Confinement to bed at once is a very good precaution, and warm applications where there is coldness of the extremities.

It may be necessary to repeat the caution against the use of cold purgative medicines, such as salts, particularly Glauber salts, Epsom salts, and seidlitz powders, which, taken in any quantity in such a season, are dangerous. Drastic purgatives of all kinds should be avoided, such as senna, colocynth, and aloes, except under special medical direction.

If, notwithstanding these precautionary measures, a person is seized suddenly with cold, giddiness, nausea, vomiting, and cramps, under circumstances in which instant medical assistance cannot be procured, the concurrent testimony of the most experienced medical authority shows that the proper course is to get as soon as possible into a warm bed; to apply warmth by means of heated flannel, or bottles filled with hot water, or bags of heated camomile flowers, sand, bran, or salt, to the feet and along the spine; to have the extremities diligently rubbed; to apply a large poultice of mustard and vinegar over the region of the stomach, keeping it on fifteen or twenty minutes; and to take, every half hour, a teaspoonful of sal volatile in a little hot water, or a dessertspoonful of brandy in a little hot water, or a wineglass of hot wine whey, made by pouring a wineglass of sherry in a tumbler of hot milk; in a word, to do everything practicable to procure a warm, general perspiration until the arrival of the medical attendant, whose immediate care, under such circumstances, is indispensable.

For reasons assigned in their first notification the General Board of Health have not deemed it necessary or proper to give instructions for the treatment of the advanced stage of this disease.

The present emergency has greatly increased the labour imposed on the union medical officers, who complain that no provision is made for their additional remuneration. Very serious, and even fatal, consequences have followed to the poor from the disputes which have arisen about remuneration for extra services. All cases of cholera, or of premonitory symptoms, should be attended at once without a relieving officer's note, and arrangements should be made accordingly. The General Board of Health would recal the attention of the guardians to the former representation of the board on this subject, namely, "seeing the many and arduous duties that devolve upon the medical officers, the board cannot but express their hope that the remuneration of these officers will be more proportionate to the value of the required services."

In the words of their first notification the General Board of Health would again urge the consideration that whatever is preventive of cholera is equally preventive of typhus and of every other epidemic and constantly-recurring disease, and would earnestly call the attention of all classes to the striking and consoling fact that, formidable as this malady is in its intense form and developed stage, there is no disease against which it is in our power to take such effectual precaution, both as collective communities and private individuals, by vigilant attention to it in its first or premonitory stage, and by the removal of those agencies which are known to promote the spread of all epidemic diseases. Though, therefore, the issues of events are not in our hands, there is ground for hope, and even confidence, in the sustained and resolute employment of the means of protection which experience and science have now placed within our reach.

By order of the General Board of Health,
HENRY AUSTIN, Secretary.

THE TREATMENT OF EPIDEMIC CHOLERA.

On Thursday evening, the 16th inst., an extraordinary meeting of the South London Medical Society was held at the Literary Institution, Borough-road, Southwark, for the purpose of discussing the nature and treatment of the prevailing epidemic.

Mr. J. Hilton, F.R.C.S., took the chair at seven o'clock, supported by the honorary secretaries of the society, Mr. J. Hicks and Mr. P. J. Murphy. About fifty professional gentlemen of the district were present.

The Chairman said he was not prepared with any experience of his own, but, as the cholera was on the decline in the southern portion of the metropolis, where it had raged with greater virulence than elsewhere, he had thought it would be advantageous to the public if the experience of the members of that society, who had been so laboriously occupied in the treatment of cholera cases, could be extended over a larger area of the profession. He would suggest that

in the remarks which any gentleman might offer it would be desirable if he would endeavour to establish some principle or striking fact rather than to detail the treatment of particular cases. It would be important if any one could adduce any proofs of the communicability of cholera or otherwise. They might be unable to prove that it was not contagious, but if it could be proved that it was communicable from one person to another a great point would be established.

Mr. Wright believed in the communicability of cholera, and mentioned a case of a young woman who had been in a house where cholera prevailed, who had taken it into a house in a comparatively healthy neighbourhood.

Mr. Waterworth wished to know whether there had been no cholera in the immediate neighbourhood to which it was alleged it was conveyed by this young woman?

Mr. Wright believed there was cholera not far off, but that there had been no case within a few doors on each side of the house to which she was supposed to have taken it.

Mr. Waterworth: To prove the contagion there ought to have been no case in the neighbourhood. The case cited proved nothing respecting the contagiousness of the disease.

Mr. Hicks, having seen a considerable number of cholera cases, thought they might be divided into three classes; first, those depending upon neglected diarrhœa, which might probably have existed for the greater part of a fortnight. This class of cases were amenable to treatment. The next class were infected with a poison of a more serious character; they were attended by purging and vomiting, but still the patients were not in a complete state of collapse, and the disease might be checked at this stage, if the patient were not too far gone in a state of collapse. But in the third stage, where the patients were in a state of complete collapse, although he had applied mustard poultices, together with brandy, chloroform, ether, ammonia, and other stimulants, yet in no cases at this stage had these remedies been attended with success. With regard to the second class of cases, at least, he believed the disease was not contagious. There had been instances where two or three cases had broken out in the same house, but in every instance in which he had seen an extension of the disease it could be traced either to some open privy at the back door from which a stench was emitted, or to noxious vapours of some character or other. In nine tenths of the cases that had come under his notice the appearance of the cholera had been preceded by diarrhœa, although he had certainly witnessed some cases where no previous diarrhœa had existed, and these cases were the most fatal, for the persons so attacked were struck down as if from some morbific poison, from which they never rallied. It was rather remarkable that the worst cases which had come under his notice were those in which he had been called up about four o'clock in the morning.

Mr. Hankins had not been able to trace any proofs of the contagiousness of cholera.

Dr. H. Lane begged to make some lengthened observations on the subject-matter of the present meeting, and was proceeding to detail the results of his practice in Liverpool in 1832, when he was stopped by

The Chairman, who said that the object of the meeting was to elicit the results of the experience of the members of the present society.

Dr. Murphy had seen the cholera of 1832 and that of the present year, and he had very little doubt that it was contagious and communicable. He regarded all epidemics as contagious; endemics were not. In every country that was insulated the disease had made its appearance in some seaport towns. In 1832 the cholera was introduced into this country at Sunderland, and afterwards at Liverpool; in Ireland it first appeared at Drogheda. He believed that the cholera was communicable even from a dead body. With regard to the treatment in the stage of collapse, he feared that he only knew what remedies did no harm, for he knew of no certain means of cure. Every epidemic made its attack on the mucous membrane, and bleeding in any epidemic was, he believed, injurious. The cause of death in cholera was from the serum of the blood exuding and passing from the blood to the intestines. He (Dr. Murphy) was the first medical man who ever used saline injections. Out of thirty-two cases at Liverpool in 1831-32 in which he had used saline injections eight recovered, and the rest died. These eight were the youngest persons; the older persons always died under this treatment, and, as there was some reason to believe that the eight recoveries would have been effected without the saline injections, they were given up. When the collapsed stage arrived, unless galvanism did something, no other remedy was capable of propelling the crassamentum of the blood through the veins, separated as it was from the serum, which had almost disappeared. Nothing but a solid kind of coagulum remained in the veins and arteries, and how the heart was to be made to push this coagulum through was a problem he never had been able to solve.

Dr. Barlow was of opinion that cholera was in some cases contagious. He concurred in what had been said respecting the impotence of medical treatment when the disease was malignant and had arrived at its latter stages. In the worst cases that he had seen, where recovery had followed, little or nothing had been done; perhaps a little calomel and camphor had been given, but the patient had not been exhausted by over heat, or the heaping up of bedclothes.

Dr. Rees had had a great deal of experience of cholera in the Bermondsey workhouse, but he was free to confess that, although he had seen a very great deal, he knew very little of it. He had tried several plans, and he did not believe any one possessed any advantage over the other. He had tried the application of cold water to the surface; charcoal had also been greatly recommended; and he had used carbonic acid. The calomel and opium treatment had also been tried freely, and he was now trying the bichloride of mercury; but, so far as he had seen, no single plan, he repeated, showed any great advantage over any other. But, whatever plan of treatment he adopted in cases of Asiatic cholera, he always supplied water to the surface and gave saline fluids for drink. These two remedies did not attack the causes of the disease, but they tended to supply that which was leaving the system, and the practitioner had then to look for something to neutralize the poison. The true remedy for the disease would, in his opinion, be found to be something that would unite with animal poison, such as bichloride of mercury, arsenic, creosote, tannin, &c. Whenever the happy discovery was made of the real remedy he anticipated they would see so marked an effect from its administration as to leave no doubt as to its efficacy. But he should always persevere in the application of cold water to the skin, and in giving saline fluids, and he would then use some antidote to the poison, which he believed existed in the blood. A large dose, if he might so speak, of this cholera poison would destroy life at once by its effect on the nervous system. A less dose acted by inducing purging of the serous parts of the blood, and if the man were strong enough and had a healthy frame he might recover by the passing away of the poison. He considered the cholera to be contagious in the true sense of the word. He did not say that medical men incurred much danger in visiting a patient, but persons living in a cholera atmosphere, and remaining long about cholera patients, were likely to take the disease. He thought that those young men who were undertaking the care of cholera patients in the workhouses of the metropolis were deserving of the greatest credit for the zeal and devotion they were displaying in those pesthouses—(Hear, hear).

Mr. B. Evans held the same opinion as previous speakers, that in certain circumstances and in a great degree the cholera was contagious. The treatment he had adopted with the most success had been to give one dose of three or four grains of opium, and from ten to twenty grains of calomel, and if the patient were not in the actual state of collapse he found this efficacious, if followed up with ice occasionally given internally, and plenty of water, stimulating the body with mustard. It was said that the secretion of urine was suppressed in cases of cholera, but he had seen a remarkable case of exception to this rule. A patient complained of great weight in the lower region of the stomach, and, feeling the bladder distended, he passed a catheter and drew a pint and a half of urine, to the great relief of the man. Twelve hours afterwards he did the same, with the like result. He should now be inclined to pass a catheter in similar cases, to see whether the urine were simply retained or whether the secretion were really suppressed.

Mr. Gaslee and Mr. Wright regarded it as established by the experience of 1832 that the vast proportion of cholera cases where characterized by the suppression of urine, and by the empty state of the bladder after death.

Dr. Crisp concurred in this view. The contagious nature of the disease was a most important question, which had been *sub judice* for years, and which would probably always remain so. He agreed that in the more malignant stages of the complaint medical assistance was but of little avail, but good nursing and great attention were of the utmost importance. He should regret if the opinion should prevail that the disease was highly contagious, because it would be in vain to expect that nurses would attend to cholera patients if such were the case. He had often been asked by nurses, and those in attendance on the sick, "Am I likely to take the disease?" and he always replied to such questions, "I believe not." No evidence that the cholera was contagious had ever been adduced to satisfy him. They were often referred to the cases of healthy persons, who came from the country, who were attacked with cholera and died; but they must allow something for the effects of grief in those cases, and for the feelings of dread and depression that accompanied the spectacle of this malady. He had received a letter from his brother, while on his passage to India in the Tulloch, stating that two cases of Asiatic cholera had broken out amongst the crew; but only two cases in a ship containing, perhaps, 400 or 500, passengers and crew, did not prove that the disease was of a contagious nature. He agreed with Dr. James Johnson in thinking that the cholera was not contagious, although, under certain circumstances, as where persons were huddled together in ill-ventilated rooms, it might be communicable. He had never heard a single instance to prove that the cholera was contagious in the true sense of the word. He had read with much interest the letter of Dr. Ayre, of Hull, in the *Lancet*, detailing the successful results that had followed the administration of two grains of calomel every ten minutes, with one or two drops of the tincture of opium occasionally in a little water. He had tried it in one case, and he could not give a better proof of his confidence in this treatment than by saying that if he were attacked by cholera he would take two grains of calomel every ten minutes with one or two drops of tincture of opium at intervals. He was not aware that this remedy had been tried in London to any extent, and he should be glad to know whether any gentleman present had made a trial of it?

Mr. Mitchell had tried Dr. Ayre's plan in one instance with perfect success. A man had staggered into his surgery in a state of collapse, and how he managed to get there in such a condition was a matter of wonder to him. He recommended his assistant, who attended the man, to try Dr. Ayre's remedy, and this, accompanied by the application of the wet sheet, restored the action to the skin; the man had a distinct pulse, although when he entered his (Mr. Mitchell's) surgery he had no pulse whatever, and he had since rallied, and would, he had no doubt, recover, although he had no hopes of him when he left his surgery. He had not seen so satisfactory

a case of recovery as from following Dr. Ayre's remedy in conjunction with the wet sheet.

Mr. Dandy thought the question of contagion had been set at rest, and that the experience of 1832 had proved that the cholera was not contagious. He did not believe that any proof existed that the cholera had been communicated from a dead body. The cholera sometimes broke out without previous diarrhœa, and it was not advisable to wait for diarrhœa before they used their preventive treatment, a course which had been too much recommended by the newspapers. The only real antidote for cholera was calomel.

Mr. Evans wished to know whether Mr. Dandy had not known cases of diarrhœa to run on into cholera?

Mr. Dandy: Frequently.

Dr. Hughes said he knew very little of the subject-matter of discussion when he entered the room, and now he knew less—(A laugh). All the gentlemen who had spoken appeared to hold different opinions as to the best remedy for cholera. He believed in the contagiousness of cholera, and that it might be communicated from person to person and in a healthy district. The medical profession in general supported the doctrine of contagion.

Mr. Dandy believed the essence of cholera to to be different from that of diarrhœa, and that it was essential to the production of cholera that there should be previous diarrhœa.

Dr. Hughes thought there were large secretions in the intestines before persons were hurled down by the cholera in cases where there had been no previous diarrhœa. Although the excretion might not take place, yet the secretion did, and thus accumulations of rice-water took place, which at length found vent. It was a mistake on the part of the public press to suppose that drains and cesspools produced cholera, but, if they were right, then the commissioners of public health had adopted the very means likely to produce that complaint. Instead of taking their measures years ago, they had stirred up all sorts of abominations. They had removed dunghills and cesspools, and added fuel tenfold to the fire that existed—(Hear, hear). Never since he could recollect had there been such accumulations of abominable odours as since the Health of Towns Commission had attempted to purify the atmosphere—(A laugh, and "Hear, hear").

Mr. Hicks agreed that there were cases of cholera without previous diarrhœa, but from his experience he could say that in 19 cases out of 20 there had been neglected diarrhœa, although there was frequently a great objection on the part of patients to admit they had previously suffered from diarrhœa. He was so far from thinking the public press had been in error in warning the public against the first symptoms of diarrhœa, that he believed the lives of hundreds had been saved thereby.

Mr. Dandy had had a return put into his hands from South Wales, in which out of 963 cholera cases 240 had not been preceded by diarrhœa.

Mr. Mitchell said that in 120 or 130 cases of cholera that had come under his observation every one had been preceded by diarrhœa for a longer or shorter time.

Mr. Casey had seen cases in which the kind of active mercurial treatment recommended by Dr. Ayre and others had been pushed too far, and where a fatal vomiting had supervened.

Mr. Waterworth said the calomel treatment had been tried in 1832, and had failed. Until they knew something of the nature of this poison, whether it was in the nervous system or in the blood, it was impossible and useless to go into the treatment of the disease. He had been of opinion, in 1832, that the evidence did not bear out the doctrine of contagion; but this opinion had been a little shaken by his experience of the present malady, which had put on somewhat the character of communicability. In cases in which collapse had taken place, he thought he had seen more recoveries where nothing had been done than where he had interfered, if the power of nature were sufficient to throw off the poison.

It was suggested that the meeting should adjourn until that day fortnight.

The Chairman said the ordinary meeting of the society would take place in the early part of October. They had not acquired much information that night regarding the treatment of the disease, and he did not know whether gentlemen would be likely to have made up their minds that day fortnight.

It was, however, resolved that the meeting should be adjourned until that day fortnight, and after the usual vote of thanks to the chairman the meeting broke up.

METROPOLITAN COURT OF SEWERS.

A special court was held on Monday, the 20th instant, at the office of the commission, 1, Greek-street, Soho, for the purpose of receiving plans for the drainage of the metropolis. It will be remembered that four weeks ago the court decided that the schemes of Mr. Phillips and Mr. Austin should be considered on that day, and that the court would be open to receive any other suggestions on the subject that might be brought forward. When, therefore, the court was opened at ten o'clock it was immediately crowded with civil engineers and others, who had sent in plans and were anxious to ascertain the fate of them. There was a very full attendance of commissioners, and it was expected that the proceedings would possess unusual interest. In the absence of the Lord Mayor, who was detained in the City by unavoidable business, Sir John Burgoyne occupied the chair. His lordship appeared in court during the sitting for a few minutes to apologize for being unable to attend. The walls were hung with two immense plans—the one illustrative of Mr. Phillips's scheme, the other of Mr. Austin's. The other competitors who thronged the room were evidently in a state of great excitement on the subject, and the commissioners seemed quite taken aback by their numbers and the extraordinary amount of rivalry that had been excited. The secretary announced that he had received fifty-three plans before ten o'clock in the morning, and three or four since, and during the sitting several more were sent in. Captain Vetch, Mr. Bullar, Mr. Johnstone, and others applied for an extension of time, as they had received communications complaining that the period of one month already given was wholly inadequate. All the commissioners agreed that further delay was necessary for the due consideration of so important a subject; and this view was confirmed by the secretary, who, when it was suggested that the communications received by him should be read, informed the court that if they sat till that time next day they could hardly then get through the mass of manuscript sent in. A long discussion after the manner of the Court of Sewers then arose as to the course which should be adopted under the circumstances. Various resolutions were proposed, objected to, amended, and withdrawn again. Mr. Leslie, amidst the loud applause of the competitors present, urged that steps should be taken for protecting the plans sent in from the possibility of plagiarism. Other commissioners took up the same view—each suggesting what seemed to him the most efficient means for doing so. The necessity for furnishing the other candidates with information about the levels of the metropolis, so as to put them on a more equal footing with Mr. Austin and Mr. Phillips, was also discussed at length, and the best and least expensive mode of doing so considered. It would be quite useless to attempt a detailed report of the proceedings, which lasted for nearly three hours, and consisted entirely of short and irregular conversations upon the different topics already alluded to. Throughout there was a total absence of that formal procedure which the idea of an open court generally carries along with it. The result of the sitting will be collected from the following resolutions, which were at last agreed to unanimously:—

"That the plans for the drainage of the metropolis already sent in be received.

"That the time for sending in plans, and for developing those already received, be extended to the 1st of October next.

"That the court, at its rising, adjourn to the 3d of October, at ten o'clock.

"That each of the competitors who have already sent in plans be requested to send in, during the course of the week, a concise statement of the main features of his plan, whether in principle or in detail, and that such statement be printed for the commissioners.

"That outline maps of the metropolis, with such information as to levels as exists in the office, be forthwith prepared and lithographed; that each of the competitors who have already sent in plans be, on his application for the same, supplied with a copy gratuitously; and that every future competitor be supplied with a copy at a charge sufficient to cover the cost of paper and printing.

"That sections of the borings made by Mr. Smith, Mr. Phillips, or others, with reference to the drainage of the metropolis, be lithographed and circulated among the commissioners."

It was stated in court that a bed of London clay had been ascertained to exist at a point down the river where Dr. Buckland assured the court on a former occasion that it was not to be found.

THE HEALTH OF LONDON DURING THE WEEK.

[From the Registrar-General's Return.]

It is one of the characters of epidemic diseases that in some years their fatality is inconsiderable, in other years excessive. Since 1832 and 1833 cases of cholera have appeared in the tables, but the deaths in the second week of August, during the past five years, have fluctuated from 1 to 23. In the week ending Saturday, August 18, the deaths in London were 2,230, of which 1,230 were by cholera, 188 by diarrhœa. The deaths from all causes in the last seven weeks were 1,070, 1,369, 1,741, 1,931, 1,967, 1,909, and 2,230; the deaths from cholera, 152, 339, 678, 783, 926, 823, and 1,230. The deaths from cholera exceed those in the previous week by 407; but in that week the mortality declined. The population is about 2,206,000, so that nearly one in 1,000 of the inhabitants now die weekly. The deaths from all diseases, except cholera, are 1,000, which is the average number of the season; and 539 were at ages under 15; 256 at the ages 15-60, 205 at the age of 60 and upwards. Of the 1,23 persons who died from cholera, 318 were under the age of 15; 721 were 15-60, and 191 were 60 and upwards; it carries off an excessive proportion of people in the prime of life. 597 males and 633 females died of the disease last week; at an earlier period of the epidemic the deaths of males exceeded those of females. Of 6,194 persons who have died of cholera in London since September 1848, 3,524 died on the south side of the Thames. It has now crossed the river. The mortality last week increased in the districts of St. George, Southwark, Newington, and Lambeth: it broke out with extraordinary violence in Greenwich; and on the north side of the Thames, in Stepney, Shoreditch, and Bethnal-green, 55, 98, and 125 deaths were registered. The deaths from cholera in the last two weeks were 35 and 125 in Bethnal-green, 21 and 98 in Shoreditch, 24 and 55 in Stepney, 42 and 76 in the districts of the east, west, and city of London, comprehending the jurisdiction of the City, properly so called, 7 and 24 in Marylebone, 17 and 34 in Westminster district, 5 and 20 in Chelsea.

This excessive mortality must be viewed with great regret. Looking to the authentic reports of the effects of general sanitary measures, and of efficient medical relief placed within the reach or carried to the homes of the people, it is quite evident that the measures now in operation are

unequal to the emergency. The classes which have the greatest claim for public succour are not idle habitual paupers, but the hard-working artisan; yet it is stated that in some parishes the arrangements are such that medical relief is not procurable directly from the district medical officers, who are, to the utmost extent of their powers, discharging their painful duties with praiseworthy diligence and humanity. In a disease which so often attacks in the night, and is fatal in twenty-four hours, the poor have to procure orders before they can be treated. Unless some change be made in these simple administrative arrangements, the mortality from cholera may be higher than it has yet been in London.

To render all the assistance which the registration system can afford for the discovery and removal of the causes of cholera, the registrars were last week requested to state in each case "whether the house or street in which the death occurred was close, ill cleansed, overcrowded, or otherwise unfavourable to health." The results will be found in the notes, which show, besides, the sex, age, profession, duration of disease, date, and place of death, in every fatal case of cholera and diarrhœa registered during the week.

The following remarks are by the registrars of the respective districts named:—

St. Martin's-in-the-Fields, Charing-cross. Mr. Leonard, registrar and district surgeon, states that "the cases of diarrhœa running into cholera increase rapidly in my district; but, as long as the white or serous hæmorrhage from the bowels has not reduced the vital powers so as to produce coldness of surface, anxiety of countenance, and failure of pulse, the following practice has been of service in 114 out of 120 cases:—On first application, a grown-up person has had administered a draught composed of powder of opium, 2 grains; sulphuric ether, 20 drops; and strong peppermint-water, 1½ oz., mixed; and in an hour afterwards the following styptic mixture:—'a table-spoonful after each liquid motion,' or, if less urgent, 'every four hours':—

Mixture of precipitated carbonate of iron, 3 oz.
Powder of opium, 2 gr.
Mucilage, 3 oz.
Peppermint-water, 2 oz., mixed.

"Having used at first Dr. Saunders's formula with the rubigo ferri, I stated to Mr. Linder, the chemist, 104, Strand, that I thought it would have a more certain effect if more finely levigated. He suggested the use of the precipitate, which is thus prepared:—

Sulphate of iron, 3 oz.
Carbonate of soda, 25 dr.
} Dissolve each in any quantity of water, and mix.

"Allow the precipitate to fall, pour off the supernatant solution of sulphate of soda, wash the precipitate with two fresh waters, and allow the precipitate, thus formed, to be suspended in 30 oz. of water for 'the mixture.' After checking the serous hæmorrhage, other treatment, well known to the profession, is required to restore tone."

St. Giles's; North.—Mr. Simpson, the registrar, states that "deaths from cholera and diarrhœa (ending Saturday last), in Church-lane and its immediate neighbourhood, have continued to increase, independent of the mortality from cases removed out of his district into the workhouse. A case appeared in last week's report of the deaths from cholera of Margaret Conolly and her child, living at 21, Church-lane. The husband, becoming alarmed, removed with his family, consisting of an infant three weeks old, his mother, and father-in-law, to 4, Lloyd's-court, where the three latter were immediately attacked with cholera and died, making five deaths registered in a family of six. Another painful case appears this week in Church-lane; in the house No. 7 four deaths have been registered in one family, a shoemaker of the name of Johnson, his daughter, aged 14, a son 16, and another daughter 23, the latter of whom was to have been married on the day she died. Next to this house, No. 8, are two deaths from cholera of persons of the name of Madden, a mother, aged 38 years, and her infant eight months. At 24, Tower-street, a woman of the name of Reed and her three children were attacked by this epidemic; two of them are dead, and the wife's death is hourly expected. The husband, Richard Reed, a lodger, states there has been a most offensive smell for some time in the house, that the landlord last week opened the drain which receives the contents of the privy, and stirred up the mass, when they were all four immediately taken ill; previously to this there was no illness in the house, or cholera in the street."

West London; South.—Mr. Nason, registrar, particularly calls attention to Bride-lane and the surrounding districts. Mr. Nason's opinion is, "that disease arises from a new sewer made in Bride-lane, which is affected from the tide arising from the Fleet-ditch, which runs into Bridge-street, and at high water appears to throw out the noxious gases generated therein."

Bethnal-green; Hackney-road. — Mr. Murray, the registrar, says, "The fatal nature of the calamitous visitation which has afflicted only a very limited though densely-peopled portion of my district seems to point at human agency in the production of the said catastrophe. These deaths have chiefly happened in a space of about 400 yards by 150, and are much below the truth, because numerous patients have been taken in various conveyances to the Bonner's-hall Workhouse, and the result will doubtless appear in future returns. The dense nature of the population, the imperfect drainage, and the irregular habits of at least a part of the people, have been often described. On inquiry, it appears that in portions of this part of the district, as in Turville-street, there is a sewer and a communication from the privies thereto, but no drainage for the waste water, which is uniformly thrown into the street. Be this as it may, there is still the fact that few deaths have occurred beyond the specified area, and there must be some adequate cause for so singular a phenomenon. The 12th, 13th, and 14th of this month will long be remembered in this neighbourhood; the outbreak of this fatal disease being without any adequate preparation; surgeons wanted in many places at once; the hurried passing and repassing of messengers, and the wailing of relatives, filled the streets with confusion and woe, and impressed on all a deep sense of an awful calamity."

Clerkenwell; Pentonville.—Mr. Pyne, the registrar, says, "Mr. Butler, the medical gentleman, informs me that in the house 8, Union-square, 4 cases of cholera have occurred; 2 have died, 2 recovered, and 2 after leaving the house had cholera, 1 died, 1 recovered; the water-closet communicates with the house. In the next house 2 cases of cholera have occurred, 1 died, 1 recovered; 2 houses further off a case of cholera fatal in 7½ hours. A large cesspool is said to be in the centre of the court with an open drain and no trap to it; the water the people drink comes within one yard of the cesspool. The waterclosets are full, having a drain to carry off the overflowing into the above-mentioned cesspool. In the whole of this division of Pentonville there is no sewer, and large houses with 20 to 30 inhabitants have only a small barrel drain to carry off the soil and other refuse. He has likewise been all hours in this court; the smell from the drain and waterclosets is intolerable, especially at night, and almost every inhabitant of that court, and the courts immediately behind it, has had cholera or diarrhœa."

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Edmund George Pinchbeck, of Fleet-street, in the city of London, for improvements in certain parts of steam-engines. Patent dated February 6th, 1849. Enrolled August 6th, 1849.

This invention is principally applicable to that class of marine engines known as oscillating engines, that is, with the cylinders supported and oscillating on gudgeons formed thereon. The object of the present improvement is to effect a saving of the room occupied by the engines. Oscillating engines, as ordinarily constructed, have the cylinders placed in a line, transversely across the vessel, immediately under the main shaft, with the air-pump occupying a similar position between them, and worked from a crank of short radius on the intermediate shaft, the whole of which necessitates the placing the cylinders at a considerable distance apart. Now, according to the present improvement, the cylinders may be placed close together, and the intermediate shaft constructed without a crank, having simply to connect the paddle-shafts; the crank or cranks for working the air-pump or pumps being formed of one and the same piece with the main crank. The patentee forms these cranks of a less radius than the main crank, by throwing back one arm of the double crank a sufficient distance to form a crank-pin that will describe a circle of less diameter than the main crank-pin, so as to impart a shorter stroke than the stroke of the steam piston to the air-pump bucket or piston, this second crank-pin being employed to work the air-pump in lieu of the crank on the intermediate shaft; care must be taken that the second or supplementary crank-pin is sufficiently large to ensure the requisite strength of the main crank; one or both the main cranks may be so constructed, according as one or more air-pumps are employed. In working the air-pumps by these supplementary crank-pins, the pumps may be connected directly with such cranks by placing the pumps at an inclination suitable for being so connected; or they may be placed in a vertical position, and the motion transmitted to the pump-rod by means of a lever or beam, one end of which is connected with the supplementary crank, and the other with the air-pump rod, so as to impart the necessary reciprocating motion to the air-pump bucket or piston. The patentee does not confine the use of the supplementary cranks on the main cranks to the working of the air-pumps alone, as the same will be equally applicable to the working of other pumps, or parts of machinery requiring reciprocating motion, to which purposes they may be applied with advantage, instead of other means employed.

What he claims as his improvement is:—First. The double main crank herein described, having a crank-pin of short radius, formed of a solid piece of metal with the rest of the said double crank, for working the air-pump rod, either by direct action, as hereinbefore described, or by the intervention of a lever.

Secondly. The application herein described of such double main crank, or of such double main cranks, for the purpose of working the rod or rods of any other kind of pump or cylinder and piston, or other pieces of mechanism, operating with reciprocating motion or motions, of less length of stroke than the stroke of the piston of the steam-engine to which such double main crank or cranks is (here a serious omission takes place in the specification of the words "*or are*") applied for such purposes aforesaid, and which last-mentioned double crank or cranks may be applied in place of, or in addition to, the double main crank or cranks for working the air-pump or pumps, according to the first part of these improvements.

William Wilcocks Sleigh, of Stamford-Brook-house, Chiswick, in the county of Middlesex, M.D., for a means of preventing injuries to persons and property from the sudden stoppage of railway carriages. Patent dated February 8th, 1849. Enrolled August 8th, 1849.

This invention relates to improvements in, and the application of, breaks to railway carriages, by which to retard the velocity or effect a complete stoppage of the train. One set of breaks is constructed so as to take effect on the peripheries of the wheels, while another grips both rails, and may either be applied simultaneously or separately, as desired. The improvement

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A more extended List will soon be published.

The chief aim of the Editors is to supply, early and faithfully, an Abstract of, or Guide to, every Book or Paper of practical value, appearing either separately or in contemporary Journals. They strive to place the busy or isolated Practitioner, as much as possible, on a level with those whose leisure and locality afford them daily access to the best libraries. To render the work easily available as an Annual Guide to British and Foreign Medical Literature, a precise and elaborate Index will accompany the December Number, *i.e.*, the last number of the yearly volume. It forms an essential part of the plan to exclude all personal controversy and exasperating polemics,

MEMORANDA.—Original Communications for the Journal, and Books for Review, are to be sent (free of expense) to the Editors, 100, St. Martin's-lane.

Advertisements are received at the same place, up to the 25th of each month.

The trade is supplied with the Journal through Messrs. Taylor, Walton, and Maberly, 28, Upper Gower-street, and Ivy-lane, Paternoster-row.

The Office for the Postal circulation is at 100, St. Martin's-lane.

Gore-house, March 31, 1849.

Count d'Orsay begs to say that the Trousers fit beautifully, and that he entirely approves of the Doeskin Prussian Manufacture, as well as of the Patent Vulcanized Rubber Strap, which is incomparably superior for comfort and neatness to all other straps he has tried.

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A Newly-invented Style of Cape and Overcoat united, produced with the greatest care and elegance for the use of the Nobility and Gentry frequenting the opera, ball, rout, and other fashionable réunions.

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is made in the same shape as the Opera Envelope, but of stronger and waterproof materials, for driving, riding, &c., and will be found a very agreeable railway companion.

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"Parisian style, and the study of principles of cutting and making, founded on correct knowledge of the anatomy of the human frame."

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H. D. DAVENPORT, Secretary.

Macord's Transparent Waterproof ISINGLASS PLASTER, and ISINGLASS PLASTERS on all FABRICS, are manufactured at 58, Minories, Londou, and can be obtained of any Druggist or Surgical Instrument-maker.

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"Surgeon to the Tyrone Infirmary.

"To Mr. R. Macord, 58, Minories."

MACORD'S WATERPROOF ISINGLASS PLASTER, 1s. 6d. per yard; 14 inches wide, on white or black calico. Directions :—Dip in warm water.

PATENTEES, GUTTA PERCHA COMPANY, WHARF ROAD, CITY ROAD, LONDON.

To Manufacturing Chemists, Bleachers, Oil Merchants, &c.—The Gutta Percha Company beg to bring under the notice of Chemical Manufacturers, Manufacturers of Chloride of Lime, Liquid Manure, and others employing Alkalis and Acids, the advantages arising from the use of Vessels and Tubes made of Gutta Percha. This substance is perfectly alkali and acid proof, being affected only by the strongest oil of vitriol and nitric acid. The most highly concentrated acetic, hydrofluoric, and muriatic acids, an chlorine, being without action upon it; it is also unaffected by any of the cold fixed oils.

Tubing of every size, lining for tanks, galvanic troughs, carboys, bottles, flasks, rollers, bowls, buckets, mugs, ladles, cord, and syphons, may be had to order.

Surgeons can be supplied with Gutta Percha Sheeting in any quantity or colour, for splints in fractures, diseased joints, luxations, &c. By immersiug in boiling water it becomes perfectly soft, and can be accurately moulded to the contour of a limb; it hardens immediately when cold water is applied. To the country surgeons it is invaluable, on account of its ready adaptation to numerous surgical purposes, even to the stopping of a decayed tooth.

The tubing, being so extraordiuary a couductor of sound, is now extensively applied for conveying messages from one room or building to another. It is invaluable in mills, factories, &c.

The Gutta Percha Driving Bands continue to give the utmost satisfaction.

Every variety of Gutta Percha articles manufactured at the Company's Works, Wharf-road, City-road, London; and sold by their Wholesale Dealers in Town or Country.

consists in the application of the toggle-joint to transmit the pressure on to the wheels in the one case, and on to the rails in the other. In the case of the wheels the friction surfaces or breaks are applied to the peripheries of two wheels on the same side of the carriage; their position being at an angle of 39° with the horizontal line, and above the centre of the wheels; each towards the middle of the carriage. The breaks are furnished with rods jointed thereto, and placed in a radial direction with respect to the wheel; or, in other words, are at about the same angle as before mentioned, so that they meet somewhere in a vertical line midway between the wheels, at which point these rods are jointed, and also to a vertical rod passing upwards to the roof of the carriage. The breaks are suitably supported in their position to prevent their being carried round with the friction consequent on their application.

The rod leading above the roof of the carriage is connected with a lever of the second order, having the fulcrum on the top of the carriage; the power end being carried backwards to a position within reach of the guard; and to which the patentee applies a downward pressure, which, taking effect on the connecting rod of the toggle-joint, formed by the break-rods, tends to force them in a more direct line with each other, or to lessen the angle of their inclination; this force acting so as to force the breaks asunder, thereby causing them to press against the peripheries of the wheels; the power being, of course, greater as the break-rods approximate the straight line, or are at an angle of less inclination.

The second break is a very similar application of the toggle-joint, but in this instance the breaks are applied to the rails. The break-rods are, therefore, placed in a position tranverse to that just described, or across the line of rails; cast-iron brackets depend from the under side of the carriage, between the wheels, and on each side of the carriage, so as to retain the breaks in position, and which, when not acted upon by the downward pressure from the lever, are sufficiently clear of the rail as to present no obstruction; but when the point of junction of the rods is forced downwards, as described, the breaks bind hard upon the rails, and thereby produce the friction required. The breaks are so constructed as to embrace both sides of each rail.

The patentee claims as his invention the applying pressure to the rail, or to the wheel of railway carriages, or to both the rail and the wheel, by means of the toggle hinge or joint, as described, thereby producing a diminution of the velocity or stoppage of the carriage, irrespective of any particular modification of the shape or form of the said apparatus, or of any kind of lever, or other contrivance that may be deemed most suitable to act upon the said joint.

Henry Headley Parish, Esq., of Eaton-place, in the county of Middlesex, for improvements in safety and other lamps, and in gas-burners. Patent dated February 8th, 1849. Enrolled August 9th, 1849.

This invention has reference, first, to improvements in what is known as the safety-lamp, in which the lamp is prevented igniting any explosive atmosphere with which it may be surrounded; and secondly, to improvements in gas-burners. The oil chamber and burner in this lamp are the same as in ordinary lamps, and likewise fitted with a wire for snuffing the wick; the air for sustaining combustion is admitted through perforations in the outer casing, on a level with the gallery; it passes thence through a cylinder of wire gauze; and thence through another thickness of wire gauze in the form of the frustrum of a cone, which is carried up so as to surround the flame; this gauze figure is enclosed and covered by a metal casing, of a similar figure, but of a flatter or more obtuse cone, so that it is in contact at the top, or at the point immediately surrounding the flame, while free access for the air is allowed on the outside of the wire gauze at bottom. The wire-gauze cylinder before mentioned, through which the air first passes, is surmounted by a cylinder of glass, the lower part of which is about the same level as the wick; this forms a sort of lens, through which the light passes. The form of this glass is cylindrical on the exterior, and of about two inches in length, while the interior is smaller in the middle than at the ends, and of a concave form; this glass is enclosed by a cylinder of wire gauze; an interior glass or chimney is fitted to this lamp, through which the air is admitted, as before described, and the products of combustion pass. Immediately above the glass cylinder or lens another wire-gauze cylinder is placed, and above that the metal chimney or enclosure, terminating at the top in a disc or cover of wire gauze. The latter wire-gauze cylinder surrounds the chimney about halfway up, and admitting air on the exterior only of the chimney, which ascends and mingles with the products of combustion, and then escapes at the top of the chimney, within the metal casing, thence escaping through the disc or cover of wire gauze. The whole of these parts are suitably connected, so as to maintain their relative positions, and so as to ensure the proper admission and escape of the air, as described. In order to connect the whole of the wires in the different parts of wire gauze, the patentee subjects them to the process of electrotyping, the metal thereby enveloping and covering the whole, as if in one body, but not to such an extent as to enclose the interstices, or render them too small for the due admission or escape of the air. The wire-gauze cylinder enclosing the lens he prefers to electrotype with a coating of silver, as it serves as a reflector, and tends materially to increase the light, which is also more equally distributed thereby. Other materials may be employed for what has been denominated the lens, such as crystal, talc, or some substance sufficiently transparent for the purpose, and, instead of being concave on the exterior, it may be made convex on the exterior, and at the same time concave on the interior.

The second improvement, which has reference to gas-burners, consists in the application of wire-gauze surfaces, through which the air is caused to pass in its course to the interior of the burner. The first of these wire-gauze surfaces is in the form of an inverted cone, the apex of which terminates in the wire supporting the button or spreader, while the base is carried up to the ring of the burner. The next is the frustrum of a cone, placed base to base with that just described, while the upper part terminates just below the button; the air admitted passes through both these surfaces, and by them is more equally and uniformly distributed, and preventing the action of any side currents on the flame, thereby producing a more steady and better light; the air supplying the exterior of the flame is admitted in the usual manner.

There are no specific claims appended to this specification.

Edward Newton, of Chancery-lane, London, civil engineer, for improvements in machinery for hulling and polishing rice, and other grain or seeds. Patent dated February 13th, 1849. Enrolled August 13th, 1849. (Communication.)

The machine represented in the drawings of this specification, for cleaning, hulling, and polishing rice, and other grain, or seeds, consists of a horizontal cylinder of wire cloth, in which a set of rotary brushes or rubbers are placed; the brushes revolving in one direction, while the wire-gauze cylinder revolves in an opposite direction. The wire-gauze cylinder is mounted on its ends, at the periphery, on three friction rollers, which serve as bearings, to retain it in its proper position, and at the same time admit of its free revolution. The central brushes are supported by an axis, and receive motion by means of a strap-rigger on the end thereof. The whole is mounted on a box, or receptacle, into which the dressed rice, or grain, is received from one end of the cylinder. The other, or feeding, end of the cylinder, whereby the grain is introduced, is fitted and furnished with a conical projection, the base being to the end of the cylinder, and the supply passed in at the small end, which carries it forward to the brushes or rubbers. There are two brushes for hulling and cleaning the grain, which are secured to a wood centre, or stock, and passing, with the exception hereafter mentioned, from end to end of the cylinder, each embracing about one fourth of the circle, in the direction of their circumference. The brushes do not form one piece with the centre, or stock, but are connected thereto on one side by hinges, placed in the direction of their length, and by which their peripheries are caused to assume a position eccentric with the axis, that is, with the advance side of the brushes at a greater distance from the cylinder than the rear, which is regulated according to the grain to be operated upon, and by which it is more readily admitted between the brushes and the cylinders; the eccentricity of the brushes being regulated by means of set-screws; or wedges may be employed for the purpose. The brushes should be set, so that at their greatest diameter they should be at such proximity with the wire cylinder as to leave a space less than the diameter of the grains of seed to be operated upon.

At the feeding end rubbers of indiarubber are substituted for the brushes, which are of a diameter sufficient to rub the grain against the cylinder, and remove any hulls that may be left on the rice or grain under treatment; while at the delivery end of the cylinder a lambswool rubbing surface is substituted for the brushes, in order to polish the seeds and complete the operation. Other soft material may be substituted for the lambswool calculated to produce a like effect on the seed. The two longitudinal brushes are placed at opposite sides of the centre, or stock, and between each are placed a series of feeders, or conductors, which consist of a number of plates placed at an inclination with the direction of motion, forming portions of a screw, by which the grain is caused to traverse from one end of the cylinder to the other; the whole of these are pivoted to the stock by one end, while the other is fixed to a longitudinal bar, by the movement of which in the direction of its length the whole of the plates, or conductors, can be caused to assume a greater or less inclination; that is, with a screw of more or less rake, by which to traverse the corn quicker or slower. These conductors are formed of plate iron, and in such proximity with the wire cylinder as to cause the grain to be carried along without the plates coming in contact with any part of the cylinder, their peripheries being adapted to suit the curve of the cylinder.

The hulls, dust, and other matters separated from the grain, are passed through the wire-gauze cylinder, and received into a chamber, or space, immediately below or between the cylinder and the box for the reception of the grain, which is carried onwards and out at the end of the cylinder, where sufficient space is left between the end and the frame to admit of its dropping into the receptacle below, from which it may be removed at convenience. It is not necessary that the brushes or rubber should be driven in opposite directions, as they may be driven in the same direction, but with a difference of speed, and by which a similar object may be effected, but he prefers driving them in opposite directions.

The patentee claims as his invention:—

First. The employment of rows of brushes on a rotating stock, or centre, in combination with a surrounding cylinder of wire gauze, when such rows of brushes are made with their forward edges bevilled or made adjustable, so as to produce a like effect as described, whereby the entrance of the rice or other grain in the interval of space between the brushes and the surrounding cylinder is facilitated.

Secondly. The rows of feeders, or conductors, in combination with, and interposed between, rows of brushes, or rubbers, for the purpose of conveying the rice or other grain through the

machine; and this is in contradistinction to inclined feeders, or conveyers used at the end of the brushes.

He further claims:—

Making the feeders, or conveyors, adjustable, in order to regulate the inclination of the faces thereof relatively to the main axis, for the purpose of regulating the passage of the grain through the machine.

Thirdly. The rubber made of indiarubber at the feeding end in combination with the brushes, for the purpose of hulling the grain preparatory to the operation of the brushes.

Fourthly. The polishers made of lambswool, or other equivalent substance, at the delivery end of the machine, in combination with the brushes, for the purpose of polishing the rice or other grain preparatory to its delivery.

Fifthly. Connecting the brushes with the stock, or centre, by adjustable means, substantially, as herein described, for the purpose of adjusting the periphery of the brushes to the wire-gauze cylinder.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING AUGUST 16TH, 1849.

John Ruthven, of Edinburgh, civil engineer, for improvements in propelling and navigating ships, vessels, or boats, by steam and other powers. Patent dated August 10th, 1849; six months.—(Communication.)

Arthur Dunn, of Worcester, soapmaker, for improvements in marking soap. Patent dated August 16, 1849; six months.

Richard Archibald Brooman, of Fleet-street, London, for improvements in machinery, apparatus, and processes for extracting, depurating, forming, drying, and evaporating substances. Patent dated August 16th, 1849; six months.

Jonathan Blake, of Mount Pleasant, Eaton, in the city of Norwich, surgeon, for certain improvements in lamps. Patent dated August 16th, 1849; six months.

James Young, of Manchester, manufacturing chemist, for improvements in the treatment of certain ores and other matters containing metals, and in obtaining products therefrom. Patent dated August 16th, 1849; six months.

Louis Lenvaitre, late of Paris, in the Republic of France, but now of the Hotel de l'Univers, Blackfriars, engineer, for improvements in the manufacture of ferrules for fixing the tubes of locomotive and other boilers. Patent dated August 16th, 1849; six months.

PATENTS RECENTLY EXPIRED.

W. E. Wright, Westminster, gentleman, for an improved box for holding coals. Patent dated August 12th, 1835; expired August 12th, 1849.

J. Day, Peckham, gentleman, for an improved wheel for carriages of different descriptions. Patent dated August 14th, 1835; expired August 14th, 1849.

R. Sheppard, Newport Pagnell, carpenter, for improvements in tiles for covering roofs. Patent dated August 17th, 1835; expired August 17th, 1849.

T. R. Shute, Watford, silk-throwster, for improvements in spinning and doubling organzine silk. Patent dated August 17th, 1835; expired August 17th, 1849.

F. Bowman, London, sugar-refiner, for an improvement in the process of renewing the virtues of animal charcoal when exhausted or impaired. Patent dated August 17th, 1835; expired August 17th, 1849.—(Communication.)

H. Phillips, Exeter, chemist, for certain improvements in purifying gas for the purposes of illumination. Patent dated August 17th, 1835; expired August 17th, 1849.

W. Banks, Birmingham, manufacturer, for a certain improvement in machinery, pens, and presses, for ruling and pressing paper. Patent dated August 17th, 1835; expired August 17th, 1849.

H. Pinkus, Pennsylvania, U.S., gentleman, for improvements in inland transit, which improvements are applicable to, and may be combined with, an improved method of, or combination of methods and apparatus for, communicating and transmitting, or extending, motive power, by means whereof carriages or waggons may be propelled on railways or roads, and vessels may be propelled on canals. Patent dated August 17th, 1835; expired August 17th, 1849.

LIGHTHOUSE LAMPS.—On Friday evening, the 17th inst., three lamps were lighted at the Royal Marine Barracks, Woolwich—one a reflector of the Trinity Corporation, on Captain Huddart's principle, $21\frac{1}{2}$ inches diameter, $8\frac{3}{4}$ inches deep, with an argand lamp at $3\frac{1}{4}$ focal distance; the second with a reflector on a plan submitted by Mr. A. Gordon, similar to one he had fitted for the Cape Pine Lighthouse, on the coast of Newfoundland; and the third on the same plan as the second, with the addition of a set of four annular glass refractors. Mr. Gordon's reflector is $15\frac{1}{2}$ inches diameter, $13\frac{1}{2}$ inches deep, and has an argand lamp at $1\frac{1}{8}$ inch focal distance. The glass annular lenses are arranged at the mouth of the third, their extreme diameter being $33\frac{1}{2}$ inches. The lamps were lighted at 8.30 p.m., and the judges appointed to decide on their merits proceeded to Rainham, in Essex, six miles distant, to ascertain which plan produced the best light. Mr. Gordon's plan, with the annular glass lenses, was the best when viewed full in front; and Captain Huddart's, or the kind used by the Trinity Corporation, was the best when both were tried at an angle of seven degrees of divergence off the line of the observers. The Trinity Corporation light appeared the brightest as seen from various parts of Woolwich.

THE MINES OF KREMNITZ.—Kremnitz is by no means a picturesque town, but its situation is extremely happy. It is one of the most ancient of the free royal mining cities, and occupies a narrow gorge overhung both on the right and left by mountains of considerable altitude, which to the eastward separate it from a second similar and parallel valley. In this chain are situated the mines; and the torrent which had been our terror in the darkness, after serving to cleanse the clay and sand from the quartz which is flung up from them, rushes through the bottom of the gorge as white and as opaque as milk. At six o'clock in the morning we started to see the furnaces, and, after passing along an ancient rampart, beneath which the milky torrent ran brawling along, we arrived at a large dingy-looking edifice built under the mountain, and, walking down a plank reaching from the threshold into the building, found ourselves in a vast space, amid fires blazing furiously, and howling through the wide chimneys like beasts of prey, while the boiling metals streamed down into the moulds sunk in the earth to receive them, in floods of liquid flame. It was difficult to believe, while looking round upon this Hall of Eblis, for such it really seemed, with its fierce delight, and its dark figures flitting to and fro, armed with long iron-shod poles, that these were the scenes and actors amid which gold—that bright and coveted thing for which beauty sometimes disdains not to sell herself—which cements the friendship of nations, rules the march of armies, peoples the wide ocean with floating batteries, tempts the weak to sin and the despairing to suicide—that it was by means like these that it was brought to light! It was sickening to look upon the tattered, begrimed, half-savage seeming wretches, who were plying with their rude tools, and exciting the very flames beneath whose dense heat they were already withering; and to remember that there were fortune, and ease, and luxury in the lava-like streams that they were pouring forth, in which they could never share; but that the very atmosphere produced by this precious fusion was rapidly sapping their life-blood; and that the calculation had been made to the nicest certainty how many years human nature could on an average sustain this sordid and poisonous avocation. Such reflections are idle, however; man must have gold, and it must be bought with human lives and human suffering!—*The City of the Magyar.*

TO CORRESPONDENTS.

"Mr. Milman, Whitehaven."—We have received the communication and sample, and forwarded the latter to the direction indicated.

"A Patentee."—The wording of the specification is obscure in the extreme, and there are some most important omissions, which, we are afraid, may give our correspondent much trouble, should the adverse party proceed to extremes. The specification appears to us wholly unintelligible. Surely no properly-qualified agent could possibly have drawn it up.

"A Sufferer."—The man is an arrant quack. We advise our correspondent to apply at once to a respectable practitioner. We never give medical advice.

"B. T." (A Subscriber from the beginning.)—A cheap and simple burning lens may be constructed as follows:—Take two circular discs of plate-glass, of the requisite dimensions, and place one at each end of a shallow tube; an inch long will be quite sufficient for any size. These discs are kept in their position very firmly by means of screw clamps, in an analogous manner to the lenses for showing Newton's coloured rings. To the tube is fitted a short tube with a stopcock attached; to the end of this tube a condensing syringe is fixed, and the cavity between the glasses filled with turpentine, varnish, bleached oil, or any other suitable substance of a high refractive power. When the glasses have attained the requisite degree of curvature, the stopcock may be shut, the syringe screwed off, and the lens mounted for use.

"Mr. Browning, York."—We will make the necessary inquiries, and communicate the result privately to our correspondent.

"Contributor."—We beg to decline for the present.

"J. T. C."—The following is Langlois's process for the preparation of carmine:—Take of boiling river-water, four gallons; cochineal, in powder, one pound. Mix, and boil the mixture for ten minutes; after which add three quarters of an ounce of carbonate of soda dissolved in one pound of water. Boil again for half an hour. Let the mixture cool, and, when cold, add to it three quarters of an ounce of finely-powdered alum. Agitate rapidly until the alum is dissolved. Let the mixture now stand for twenty minutes, after which decant into another vessel. Add to the decanted fluid the white of two eggs, dissolved in a pint of water, and intermix the fluids thoroughly by stirring and shaking. Apply heat, until the liquor is clarified. Draw it now off, and allow it to repose for half an hour, or somewhat longer; after this, decant off the clear portion, collect the carmine which has subsided at the bottom of the vessel, and place it upon a filter to drain. When it has acquired the consistence of a paste, remove it from the filter with an ivory or silver knife, and finish the drying upon shallow plates, covered with silver paper. The product is one tenth to one eleventh of the weight of the cochineal employed.

"G. R."—Next week.

"Tyro."—The proper proportions are two to one or five to two. We prefer the former; the difference, however, is but trifling.

"Mr. Walker."—Next week.

THE CHEMICAL TIMES is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary or scientific communications to be addressed to the Editor, 320, Strand.

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ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

Part II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXXI.

(LECTURE CIV.)

VEGETO-ALKALIS—(*Continued*).

NUX VOMICA.

Nux vomica is the seed of Strychnos nux vomica.

This substance exercises a most energetic action upon the spinal marrow, on which account it is frequently employed as a remedial agent in paralysis and cases of nervous debility.

Nux vomica was analyzed first by Braconnot, subsequently by Pelletier and Caventou. The discovery of the presence of strychnia and brucia in nux vomica was made by the latter two chemists.

Nux vomica contains :—

Igasurate of strychnia,
Igasurate of brucia,
Wax,
Concrete oil,
Yellow colouring matter,
Gum,
Starch,
Bassorin.

The strychnia and brucia exist in the seeds of nux vomica in the saline state, viz., in combination with an acid (the igasuric), of which the properties have not yet been sufficiently studied.

The igasurates of strychnia and brucia are readily soluble both in alcohol and in water.

The medicinal preparations of nux vomica may be divided into two classes, viz., 1, the two alkalis, strychnia and brucia, either isolated or in combination with acids ; 2, pharmaceutical preparations containing, besides the two alkalis, the other constituent principles of the nux vomica.

POWDER OF NUX VOMICA.

The usual way of preparing the powder of nux vomica is to subject the seeds to the action of a rasp or grater ; owing to the horny and elastic consistence of nux vomica, the pulverization cannot well be effected by any other means. I prefer, however, to expose the seeds on a sieve to a current of steam till they get soft. In this state I pound them, and dry the bruised mass, finally, in the stove.

The powder of nux vomica is rarely used in medical practice. In most cases the comminution of the seeds is required only for the purpose of facilitating the action of solvents upon it; for this purpose the method described in the preceding paragraph may be resorted to. It is more expeditious, however, to soften the seeds by steam, and to grind them in that state in a mill similar to that used for the fabrication of sweet almond oil. From this mill the seeds issue in small, thin, and tattered ribbons, which are readily penetrated by liquids.

If it is intended to subject the nux vomica to the solvent action of water, the best way is to soften the seeds by boiling them in water, and, when sufficiently softened, to grind them in the mill. The liquid in which the seeds have been boiled serves for the ulterior operations. The process of coction must not be protracted too long, otherwise the seeds will get pasty, and unfit for the mill.

HUFELAND'S POWDER.

Take of Powdered nux vomica, 10 centigrammes.
Gum arabic, 40 centigrammes.
Sugar, 40 centigrammes.

Mix.

This powder has been used with great success in some cases of dysentery.

ALCOHOLIC TINCTURE OF NUX VOMICA.

Take of Grated nux vomica, 1 part.
Alcohol at 85 Cent., 5 parts.

Let the nux vomica macerate in the alcohol for fifteen days. Filter.

The alcohol dissolves the igasurates of strychnia and brucia, the fatty matter, and the colouring matter.

UTERINE DROPS OF THE QUEEN OF SPAIN.

Take of Extract of nux vomica, 5 centigrammes.
Alcohol at 85 Cent., 10 grammes.

Dissolve the extract in the alcohol, and filter the solution.

EXTRACT OF NUX VOMICA.

Take of Nux vomica, 1 part.
Alcohol at 85 Cent., a sufficiency.

Grate the nux vomica, and macerate the product of the operation in a suitable amount of alcohol for eight days. Strain with expression. Pour a fresh quantity of alcohol on the grounds, and macerate again for eight days. Strain with expression. Add the strained liquid of the first operation ; filter, and distil the filtrate ; evaporate the residue of the distillation to the consistence of an extract.

The extract of nux vomica may equally be prepared with water ; the use of alcohol, however, is vastly preferable ; the evaporation of the alcoholic liquid proceeds with greater speed, and the alcohol has moreover this great advantage over water, that it dissolves the whole of the active principles of the seed, without carrying into the product any portion of the mucilage which the seeds of nux vomica contain in abundance. The alcoholic extract of nux vomica is accordingly much more energetic in its action, even though administered in smaller doses, than the aqueous extract.

Nux vomica treated with alcohol yields the one tenth of its own weight of extract.

ST. IGNATIUS' BEAN.

The St. Ignatius' bean is the seed of the Strychnos Ignatia. It has the same composition as nux vomica ; it contains, however, a much larger amount of strychnia than the latter, and, on the other hand, only a trifling proportion of brucia. It is accordingly a much more active agent than nux vomica.

In India the St. Ignatius' bean enjoys a high reputation as a most efficient febrifuge. It has been used with more or less success also in cases of debility of the stomach, in epilepsy, and in amaurosis. Its medicinal virtues are attributable altogether to the strychnia which it contains.

It is not much used in Europe except for the extraction of strychnia, of which alkali it contains a larger proportion than nux vomica; but even in this respect the low price of the latter, as compared to the costliness of the St. Ignatius' bean, may be considered a more than sufficient set-off.

THE NATURAL-HISTORY FEATURES OF THE NORTH ATLANTIC; WITH OBSERVATIONS ON THE BRITISH FISHERIES.

A LECTURE DELIVERED AT THE ROYAL INSTITUTION,

By Professor E. FORBES.

The zoological and botanical provinces into which the North Atlantic may be divided are, first, an Arctic or Boreal region, extending on the American side southwards as far as Massachusetts, but on the European side confined to the extreme north ; 2d, the Celtic province, occupying the interval between the Boreal and the 3d, or Lusitanian, region (of which the Mediterranean is an arm) on the European side ; 4th, the Senegal region, the most equatorial of the eastern provinces, and corresponding with the 5th, Carribean, region on the western side of the Atlantic ; 6th, the Carolinian region, extending along the southern and eastern states of North America; and 7th, a very small province, the Bostonian, occupying the coast of Massachusetts, and intermediate between the 6th and the Boreal region of North America. The relative situation of the provinces is thus :—

THE BOREAL REGION.

The Bostonian.	The Celtic.
The Carolinian.	The Luisitanian.
The Carribean.	The Senegal.

The flora and fauna of the Boreal or Arctic region are specifically common to both sides of the Atlantic. The Senegal and Carribean provinces have a few specific relations in common. The Celtic and Lusitanian have only a relationship of representation with the Carolinian and Bostonian provinces of the western side. The several provinces are not marked out by the existence of any strong lines of demarcation, but gradually pass one into another, and are lost. In the Celtic province there are numerous outlying tracts of an Arctic character, which indicate that, at some former period, that region occupied a much larger space on the eastern side than at present ; indeed that it was co-extensive with the western. The Lusitanian province likewise extended much further northward than it now does. Geology explains this by teaching us that previous to the pleistocene period the Lusitanian province extended into the now Celtic area ; that, in consequence of a change of climate, the Lusitanian flora and fauna retreated southwards, whilst the Boreal region, which in Europe extended to a parallel correspondent to its present extension in America, retired to the north ; that during the glacial or pleistocene epoch there was a community of inhabitants throughout the seas north of the 50th parallel of latitude, when, in all probability, there existed extensive lands in the Arctic regions of the North Atlantic, along the coast of which atloral forms of animals and plants were diffused. The changes brought about at the close of the glacine period brought about a change of climate, in consequence of the destruction of the northern land, and the conversion, elsewhere, of great tracts of sea into land, causing the extinction of numerous species. A reconversion of land into sea in the newly-formed climatal region preceded the appearance of a new fauna and flora, viz., the Celtic, with which were interspersed numerous colonists from the north and south. The inferences we draw from these facts are—that the features of the first region are due to the wide diffusion of the glacial or pleistocene fauna, and the history of the changes which followed the glacial epoch—those of the 2d and 7th were of later origin, and commenced after the formation of the North Atlantic, as it is now seen—those of the 3d and 6th are due to a previous state of things, and their origin dates prior to the glacial epoch—those of the 5th and 6th are of equal, perhaps of older, date, and probably indicate a distribution of land and water in the equatorial regions of the Atlantic, hitherto unexplained. The outlying portions of the Celtic region are more ancient than the region in which they are found. It is usual to say that the presence of many plants in a given situation is determined by soil or climate, as the case may be ; but, if such plants be found in areas disconnected from their centres by considerable intervals, some other cause than the mere influence of soil or climate must be sought to account for their presence. This cause is to be found in an ancient connection of the outposts with the original centres, and the subsequent volution of the former through geological changes and events, especially those dependent on the elevation and depression of the land. Botanists well know that certain species of flowering plants are found indigenous in certain portions of the British Isles, at a great distance from the nearest assemblage of individuals of the same species in countries beyond them. Thus many plants peculiar in the British flora to the west of Ireland have the nearest portion of their specific centres in the north-west of Spain; others confined with us to the south-west promontory of England are beyond our coast found in the Channel Islands, and the opposite coast of France ; the vegetation of the south-east of

England is that of the opposite part of the Continent; and the Alpine vegetation of Wales and the Scottish Islands is nearly related to that of the Norwegian Alps. The great mass of the British flora has its most intimate relations with that of Western Germany. The oldest of the floras now composing the vegetation of the British Isles is that of the mountains of the west of Ireland. Though an Alpine flora, it is southernmost in character, and quite distinct as a system from the floras of the Scottish and Welsh Alps. Its very southern character, its limitation, and extreme isolation, are evidences of its antiquity, pointing to a period when a great mountain barrier extended from the mouth of the Bay of Biscay from Spain to Ireland. The distribution of the second flora, next in point of date, depended on the extension of a barrier (the traces of which still remain) from the west of France to the south-west of Britain, and thence to Ireland.

The distribution of the third flora depended on the connection of the coasts of France and England towards the eastern part of the channel. Of the former existence of this connection no geologist doubts. The distribution of the fourth or Alpine flora of England and Wales was effected during the glacial epoch, when the mountain summits of Europe were low—islands or members of chains of islands, extending to the area of Norway, through a glacial sea, and clothed with an Arctic vegetation, which, in the gradual upheaval of the land, and consequent change of climate, became limited to the newly-formed and yet existent mountains. The distribution of the fifth or Germanic flora depended on the upheaval of the bed of the glacial sea, and the consequent connection of England with Ireland, and of England with Germany, by great plains, the fragments of which now exist, and upon which lived the great ilk and other quadrupeds now extinct. The breaking up of the first barrier led to the submergence of that of the second; that of the second to that of the third; but the well-marked epoch of the Germanic flora denotes the subsequent formation of the Straits of Dover, and of the Irish Sea, as now existing.

Prof. Loven, of Stockholm, has lately been engaged in investigating the natural history of the Scandinavian seas, and his views of the distribution of marine animals are strikingly corroborative of those here advanced, and must, as the result of a perfectly independent chain of observations, be entitled to some respect.

Researches of this kind have a peculiarly practical bearing. They affect intimately the economic question of the value of our fisheries. The disposition of the great sea fisheries of Europe depends on the disposition of existing geological provinces of the European seas. Thus the productive regions of the capelan and of the cod tribes correspond with the Arctic and Boreal regions of the first province; the region of the herring fisheries with the Celtic province; the pilchard fisherics with the outlying portions of the Lusitanian province; the tunny and anchovy fishery with the main body of the Lusitanian province and its great Mediterranean arm; and the sturgeon fishery with the remains of the great inland Acrabo-Caspian Sea.

The value of the British seas and shores, as a fishing area, depends on the dimensions of the great bank including them, as defined in the map given by Sir H. de la Beche (Researches in Theoretical Geology); and the existence of productive cod fisherics within that area on the existence of the outliers of the ancient glacial sea. If the British Isles were elevated one hundred fathoms above the level of the ocean, and thus joined to the continent of Europe, they would be surrounded by an extensive area of flat land, for the fall from the present coast to the new sea coasts would be so gradual as to present to the eye one great plain. This hypothetical plain is at present the fishing bank of the countries to which it extends. This great bank is bounded on the W. and N.W. by a line including the British Islands, and passing round them from the coast of France to that of Norway, terminating by a sudden slope into the deep sea. It is the misfortune of this country that in almost all its fishing inquiries the results of scientific researches are neglected, and to this an unaccountable backwardness in a branch of production most natural to a nation of islanders is to be attributed. In France and Sweden we find the state consulting such men as Milne, Edwards, and Neilson; our reports, on the other hand, contains not the evidence of a Yarrell, a Ball, a Richards, and a Jardine, but that of men whom it is a kindness not to name in connection with the subject. At the moment when so much is heard of Irish distress, a source of wealth lying most invitingly on the shore is comparatively neglected. It must be regarded as a singular circumstance that hitherto no steps have been taken to render steam an auxiliary to fishing pursuits, a resort which would render the expensive harbours sometimes proposed unnecessary. Certain it is, were steps taken to collect, arrange, and diffuse knowledge on the natural history and condition of our fishing banks, not only a truer direction would be given to the enterprise now directed to fishing, but a confidence would arise, which would greatly tend to the accession of new capital to the pursuit, and afford employment for a much larger number than at present.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON A NEW BLUE COLOUR.

By M. REBOULLEAU.

In September, 1847, M. Reboulleau presented to the Academy of Sciences a specimen of arseniate of copper, the properties of which he had not, at that time, completely studied. He gives now a more detailed account of the composition and preparation of this new salt.

This substance, on account of its beautiful blue colour, merits a first rank amongst the colouring materials employed in painting. M. Reboulleau had proposed its employment both for oil and water painting; but later trials have proved that, although its use, in all cases where water colour is required, is most satisfactory, it does not answer for oil painting. The oil, which possesses a great affinity for oxygen at the moment of its drying, reacts on the oxide of copper, and the colour changes from blue to bluish-green; indeed, this arseniate acts with oil like the other blue preparations of copper.

If a mixture of equal parts of the common arseniate of copper and the neutral arseniate of potass be heated together, the mixture enters into fusion, and gives, when cold, a mass of a bluish-green colour, perfectly transparent, with a vitreous fracture, and very fusible. The compound which results is a double arseniate of copper and potass, obtained by the dry way, after the process of M. Berthier. If, during the time that this double arseniate is in complete fusion, a quantity of powdered nitrate of potash, equal to one fifth of the fused salt, be thrown in, a brisk effervescence immediately takes place throughout the entire mass, and a considerable quantity of deutoxide of nitrogen is evolved. On removing the crucible from the fire it will be found to contain a substance of a magnificent blue colour, formed of a subarseniate of potass and the arseniate of copper, in the state of a double salt, and mixed with nitrate of potass. When this compound, after having been powdered, is treated with water, the decomposition of the double salt takes place; the water holds in suspension the arseniate and nitrate of potass, and leaves a precipitate of arseniate of copper of a splendid blue colour. During this operation, at the moment when the decomposition of the nitrate takes place, the double salt, which appeared of an intensely deep green colour, changes suddenly to blue. Now, the green colour of the arseniate of copper properly belongs to the oxide of copper. If this oxide abandons its green colour, to take the blue colour, under the influence of the nitrate of potass, is not this (says M. Reboulleau) an indication that this oxide has undergone a modification in its composition? The circumstances under which this takes place are sufficient of themselves to explain in what this modification consists. Of the elements of the nitrate of potass decomposed, in contact with the arseniate, it is only to the potass or to the oxygen that we can attribute the change which the oxide of copper has undergone, as the deutoxide of nitrogen evolved in the process escapes. Now, experience teaches us, on the other hand, that the potass is not the cause of the blue colour which the oxide takes, for if, when the nitrate is thrown into the crucible, the mixture be heated until all effervescence has ceased, the double arseniate returns to its primitive green colour. It is evident, then, that it is oxygen which produces this change of colour which has been pointed out. And how does the oxygen act if not by communicating a higher state of oxidation to the copper? The return of the green colour, notwithstanding the presence of potass, acquaints us with the fact that the blue arseniate readily gives up, at a high temperature, the oxygen which it had absorbed and which had imparted the blue colour to it. M. Reboulleau draws from these facts the following conclusions:—The arseniate of copper obtained by double decomposition unites with the arseniate of potass at a high temperature, and forms a double salt of great fusibility. Whilst the salt is in a state of fusion, the addition of nitrate of potass peroxidizes the copper, and transforms the green arseniate into an arseniate of a magnificent blue colour. There exists an oxide of copper (in combination with arsenic acid) more highly oxygenated than that which colours certain salts of copper green. This oxide is stable at ordinary temperatures, but is decomposed at a red heat with disengagement of its excess of oxygen. The double arseniate, treated with water, is decomposed; the arseniate of potass is dissolved out, and an arseniate of copper remains, the blue colour of which may be usefully employed in water painting.—*Comptes Rendus.*

ON THE FORCE AND CONSTANCY OF CONTINUOUS OR CONSTANT GALVANIC BATTERIES.

By M. LOUYET.

In the researches which I have published on the galvanic coating of iron with zinc, I have been led to make several experiments on the relative value of batteries styled "constant;" for, before commencing the experiments which I had undertaken, for the purpose of verifying the law which I thought I had discovered relative to the galvanic deposit of zinc on iron, it appeared necessary that I should have a galvanic current at my disposal, of which the variations of intensity should be feeble during the space of several hours. To measure the galvanic current I have employed, as Faraday recommends, a voltameter with large platinum electrodes. The quantity of the gases developed increasing with the size of the plates of the voltameter, it became necessary, in order to obtain results capable of comparison, to employ, not only the same voltometer to measure the intensity of the current of each battery, but also to establish a relation between the size of the electrodes and the dimensions of the elements of the battery.

In my first experiments I had not taken those different circumstances into account, and it was by the advice of Mr. Grove that I have considered these first experiments as of no value, and have recommenced them, employing apparatus capable of furnishing correct results.

According to Mr. Grove, the size of the platinum plates or electrodes of the voltameter should be calculated from the extent of surface of the elements of the battery. By employing very small electrodes, and successively increasing them, the volume of the gases disengaged in-

creases with rapidity; but, if the size of the electrodes is less than that of the platinum plates of the battery (when the nitric acid battery is employed), the augmentation in the evolution of the gases is but feeble. Nevertheless, as the porous cells hinder or oftentimes prevent the action of one part of the surface, Mr. Grove constructs the plates of his voltameter only one half the size of the elements of the battery. Thus, for instance, the Bunsen battery (the largest of the batteries on which I have experimented) had about the following dimensions in round numbers:—

Interior surface of the coke cylinder 30 in. square.
Exterior surface of the zinc cylinder 18 "

Total of surface exposed..... 48

Each of the electrodes would thus have a surface of 24 inches square; but we diminish these dimensions one half to allow for the influence of the porous cells, and thus, in fact, give a surface of 12 inches square to the plates of the voltameter. The electrodes which I have employed in these experiments were of the above dimensions.

The experiments were made on batteries of four different kinds, namely:—1st, the Bunsen or charcoal battery; 2d, Grove's or the nitric acid battery; 3d, Grove's battery modified; 4th, Daniell's battery.

The Bunsen Battery.—I have before mentioned the elements of this battery. For charging it, ordinary nitric acid and sulphuric acid, diluted in the proportion of 33 parts of acid to 100 of water, were employed.

The acid liquor of the voltameter was of the same composition.

I have collected only the hydrogen gas disengaged, and in the first place employed only two couples of the battery. I must also add that the charcoal cylinders had previously been steeped for several hours in nitric acid. In all these experiments the volume of the gas was brought to a temperature of 57°.2 Fah., and a pressure of 30 inches.

Experiment.	Duration of Experiment.	The Battery was at Work.	Volumes of Hydrogen Gas Disengaged.
1	14 min.	0h. 28m.	53.5
2	"	2 30	52
3	"	2 54	51.5
4	"	3 18	51
5	"	3 49	48
6	"	6 6	50.5
7	"	20 20	47.5
8	"	20 37	36.5
9	"	20 53	30.5
10	"	21 9	28.5
11	"	21 26	28.5
12	"	21 54	30.5

It will be seen from these figures that the current is sensibly constant during the first three hours; after the lapse of twenty hours it evidently diminishes; nevertheless it is remarkable that this diminution is not proportional to the time of the charge, for in the sixth experiment more gas was collected than in the fifth, and in the twelfth more than in the tenth and eleventh.

Grove's Battery.—The porous vessels in which the platinum plates were immersed were of a cylindrical form; the zinc element was of the form of a hollow cylinder, in the interior of which the porous vessel was placed. Interior surface of the zinc, 18½ inches square; surface of the platinum plate, 13 inches square. This battery was charged with acids of the same density as those employed for the Bunsen battery. Only two couples of the battery were employed.

Eight experiments were made, lasting in the aggregate five hours forty-six minutes. The results showed the physical effects of this battery to be much less powerful than those of the Bunsen battery, with two couples; it gave but small sparks, and did not heat an iron wire to redness, whilst the other burnt a wire of the same thickness. The volume of gas disengaged was sensibly constant during the first two hours. The action of this battery became more rapidly weakened than that of the preceding.

Second Series of Experiments made with the Bunsen Battery.—In the second series the number of couples was doubled, the battery consisting of four. The duration of each experiment was reduced to seven minutes or one half.

Experiment.	Duration of Experiment.	The Battery was at Work.	Hydrogen Gas disengaged in Volumes.
1	7 min.	0h. 30m.	246
2	"	0 42	246
3	"	0 53	183
4	"	1 4	206
5	"	1 14	203
6	"	1 24	207
7	"	5 54	126
8	"	6 3	120
9	"	6 15	110
10	"	6 25	100

The current was sensibly constant only during the first hour, whilst with two couples it was constant during the first three hours. At the expiration of about six hours the current had lost one half of its intensity.

Daniell's Battery.—Surface of the solid zinc cylinder, 10 inches square; interior surface of the copper vesssl, 32 inches square. The solution of sulphate of copper placed in the copper vessel marked 23° Beaumé (sp. gr. 1.23), and strongly reddened litmus. The solution of sulphate of zinc placed in the porous vessel marked 38° Beaumé (sp. gr. 1.37): it had been strongly acidulated. The battery employed was of four couples.

Experiment.	Duration of Experiment.	The Battery was at Work.	Hydrogen Gas disengaged in Volumes.
1	14 min.	0h. 14m.	64
2	"	0 20	55
3	"	0 58	53
4	"	1 17	53
5	"	1 34	52
6	"	1 51	52
7	"	4 12	52
8	"	4 28	48
9	"	4 43	46
10	"	24 4	45
11	"	24 20	45
12	"	24 36	45
13	"	25 2	39
14	"	25 18	39
15	"	26 15	38
16	"	27 48	37
17	"	28 31	39

It must be remarked that, if the effects of this battery are much more feeble than those produced by the preceding batteries, this arises, not only from the fact that the chemical action is much less intense, but also from the circumstance that the porous vessels are much less permeable than those employed in all the other batteries which I have examined. The current of the Daniell battery is sensibly constant during the first four hours. The circuit having been open during twenty-four hours, and the experiments again undertaken without making any alteration in the battery, the quantity of gas disengaged in the experiment which followed was, so to speak, almost nothing; but afterwards the current recovered the intensity which it possessed when the experiments were stopped on the previous day. This is an anomaly which I cannot explain.

The Modified Grove's Battery.—This battery had a solid and central cylinder of zinc, like the Bunsen battery; the charcoal of the latter being replaced by three platinum plates fixed to a metallic circle, itself attached to the end of a glass cylinder.

Surface of the solid cylinder of amalgamated zinc..... } 10 in. square.
Interior surface of the three platinum plates..... } 13 in. square.

The battery was charged with acids of the same strength as the Grove's battery previously employed. The battery was composed of four couples.

Experiment.	Duration of Experiment.	The Battery was at Work.	Hydrogen Gas disengaged in Volumes.
1	7 min.	0h. 18m.	128
2	"	0 30	125
3	"	1 20	124
4	"	1 43	102
5	"	1 53	98

Conclusions.—1st. Taking into consideration equality of surface, the modified Grove's battery is the most powerful as regards the chemical effects produced. 2dly. The current produced by the ordinary Grove's battery is sensibly constant during the first two hours. 3dly. By employing four couples of the Bunsen battery we obtain during the first hours of the charge, and for an equal length of time, nearly ten times as much hydrogen gas as two couples of the same battery furnished in the same space of time. The quantity of gas disengaged is not, therefore, in direct proportion to the number of couples in the battery. 4thly. These experiments show that it is most convenient to employ a Daniell's battery when a constant current is required during a longer space of time than two hours.—*L'Institut.*

ON A CHROMATE OF COPPER AND POTASH.

By A. KNOP.

This compound, discovered by M. Knop, forms a pure light brown powder, irideseent in sunshine, and which consists of transparent, microscopic, six-sided plates. It is almost insoluble in water. In carbonate and caustic ammonia it dissolves with a deep green colour; and on the cooling of a hot saturated solution a salt separates in shining green prisms, with a play of golden yellow, and which, according to the description, appear to be the chromate of ammonia and copper prepared by Malaguti by a different process.

This potash double salt is immediately formed when recently precipitated hydrated oxide of copper is mixed with a solution of bichromate of potash; it is likewise obtained when a solution of sulphate of copper is mixed with an excess of a solution of bichromate of potash, and then caustic potash gradually added. The precipitate is at first of a paler colour, but subsequently becomes darker and crystalline.

On ignition the salt yields water and oxygen, and leaves a mixture of copper and oxide of chromium with neutral chromate of potash, which latter may at least be partially extracted by water. For analysis, the salt dried over sulphuric acid was dissolved in muriatic acid, the copper separated by sulphuretted hydrogen, and weighed in the usual manner as calcined oxide of copper. The liquid filtered from the sulphuret of copper was boiled to expel the excess of gas, and the oxide of chromium precipitated by ammonia. After it had completely separated by long boiling, it was collected on a filter, weighed after ignition, and calculated as chromic acid. The solution filtered from it was evaporated to dryness, and the salt heated in a platinum crucible to volatilize the chloride of ammonium; the potash was then weighed as chloride of potassium.

In three analyses, made with 1.478, 1.666, and 0.944 grm. of salt of different preparations, the following quantities were obtained:—

Chromic acid.....	43.549	42.665	43.261
Oxide of copper...	36.814	37.135	35.916
Potash.....	13.735	13,834	14.000

These numbers corresponded for the anhydrous salt to the formula $KO, CrO^3 + 3CuO, 2CrO^3$. As the chromic acid in the chromate of copper is converted on calcination into oxide of chromium, it must lose 3 atoms of oxygen, corresponding to 6.732 per cent. From the difference in the loss

by ignition the amount of water can be determined. 6.357 grms. salt lost on calcination 0.905 or 14.236 per cent. water and oxygen. A second experiment, with only 1.382 salt, gave 13.821 per cent. loss. Deducting the 6.732 oxygen from the first number, 14.236, leaves 7.504 for water, the oxygen in which is equal to that of the oxide of copper, and corresponds, therefore, to 3 atoms. According to theory the salt should lose by ignition 14.580 per cent. of water and oxygen, which comes sufficiently near to the amount found.

The unaltered salt consists, therefore, of $KO, CrO^3+3CuO, CrO^3+3HO$, which would probably be more correctly expressed by $(KO, CrO^3+2CuO, CrO^3+CuO, HO)+2HO$. The corresponding per-centage composition is :—

Chromic acid	43.878
Oxide of copper	34.579
Potash	13.695
Water	7.848

Liebig's Annalen.

RESEARCHES ON PEUCEDANINE.

By Dr. F. BOTE.

This substance, which was discovered by Schlatter, and more accurately examined by Erdmann, is best obtained by digesting the root of Peucedanum officinale cut into small pieces with alcohol of 0.833 spec. grav. for several hours, and then heating it with the liquid to boiling. The filtered liquid furnishes, after being slightly evaporated, crystals of peucedanine, which are freed by means of very dilute cold alcohol, in which they are very sparingly soluble, from a brown resinous mass. The crystalline mass obtained from the subsequent extracts contains far more of the smeary substance than the first, and it is not advisable to mix the several extracts and treat them in one operation. When a dilute alcohol is employed for the first extract, the produce is never so great as according to the method directed. That portion of peucedanine which the last traces of resin contain may still be obtained by diluting the hot alcoholic solution with water so long as the turbidness produced disappears by agitation and a gentle heat. After long standing, the cold liquid deposits some crystals, which are obtained perfectly pure by repeated solution in cold ether and crystallization. The small residue insoluble in the cold ether consists of Erdmann's oxypeucedanine.

Peucedanine, $C_{24}\ H_{12}\ O_6$, forms, when crystallized from ether, shining colourless prisms, which belong to the rhombic system. The crystals melt at 167° without any loss of weight; the fused mass turns brown at 266°, and a slight sublimation takes place. The most simple relation between the constituents may be expressed according to the following analysis by $C_4\ H_2\ O$:—

Carbon	70.45	70.52	4	70.59
Hydrogen	5.92	5.98	2	5.89
Oxygen	23.63	22.77	1	23.52

The above formula, although not so simple, appears to be the correct one, notwithstanding that it was impossible to prepare a combination of peucedanine with bases.

Oxypeucedanine, which has already been noticed by Erdmann, and which differs from peucedanine by its insolubility in cold ether and a higher melting-point, has, according to the author, the composition $C_{24}\ H_{11}\ O_7$.

It is formed when apparently pure peucedanine is dissolved in cold ether, when it is left behind as a granular residue, which can be freed from adherent peucedanine, although with difficulty, by frequent crystallization and treatment with cold ether. The highest melting-point which the most purified substance presented was 291°. The substance was then considered to be pure, and analyzed; the following numbers were obtained :—

Carbon	68.13	67.95	24	68.25
Hydrogen	5.35	5.38	11	5.21
Oxygen	26.52	26.67	7	26.54

Nitropeucedanine, $C_{24}\ H_{10}\ NO_9$, is obtained by heating peucedanine with nitric acid of 1.21 spec. grav. to about 140° ; the peucedanine dissolves slowly but entirely, imparting to the liquid a yellow colour. On cooling, the liquid solidifies to a laminar crystalline mass, which may easily be obtained pure by filtration and solution in alcohol. In this state it forms colourless, flexible, crystalline laminæ, which are pretty readily soluble in alcohol and ether, and are nearly insoluble in water. At 212° the substance remains unaltered ; at a higher temperature it fuses, and is, at the same time, decomposed ; it burns on platinum foil with a smoky luminous flame, like peucedanine, but with evolution of nitrous acid vapours. Its behaviour towards acids and bases is not very characteristic ; strong agents decompose it. It furnished on analysis :—

Carbon	60.06	60.02	24	60.00
Hydrogen	4.21	4.20	10	4.16
Nitrogen	5.50	5.95	1	5.83
Oxygen	30.23	29.83	9	30.01

In the treatment of peucedanine with nitric acid, Erdmann's oxypicric acid and large quantities of oxalic acid are frequently obtained as collateral products. With respect to the first, all the properties of the acid obtained from peucedanine agree with those described by Erdmann and by Will and Böttiger.

Nitropeucedaninamide, $C_{24}\ H_{12}\ N_2\ O_8$, is obtained by exposing nitropeucedanine in a current of ammoniacal gas at 212°. It increases in weight, and is finally wholly converted into the new substance. The product obtained directly in this reaction dissolves pretty readily in boiling alcohol, and crystallizes on cooling in rhombic prisms, which have almost a diamond lustre. It is equally obtained, only less readily and pure, by heating peucedanine with ammonia and alcohol.

Nitropeucedaninamide is not decomposed by weak acids in the cold, but is so on the application of heat; the liquid then contains nitropeucedanine and the ammonia salt of the acid employed. On treatment with strong bases it exhibits the character of an amidogen compound by slowly giving off ammonia on ebullition. It is readily soluble in alcohol and ether, but almost insoluble in water. This last circumstance gives rise to a very interesting reaction. If an alcoholic solution be diluted with water, the substance slowly separates, and the very slightly turbid liquid exhibits the phenomenon of dichroism in a remarkable degree. The appearance is most striking when nitropeucedaninamide containing some oxypicric acid is mixed with a solution of ammonia ; the liquid is then yellow by transmitted light, and of a beautiful azure-blue by reflected light, which last colour is still distinctly perceptible with the greatest dilution. This reaction furnishes a means of discovering the smallest quantity of nitropeucedaninamide, and consequently also of nitropeucedanine and peucedanine. On analysis, nitropeucedaninamide furnished :—

Carbon	57.85	24	58.06
Hydrogen	4.89	12	4.83
Nitrogen	11.09	2	11.29
Oxygen	26.17	8	25.92

—*Journ. für Prakt. Chem.*, xlvi., p. 371.

ON THE PRESENCE OF ALLANTOINE IN URINE.

By M. WOHLER.

The allantoic liquid of the cow is generally considered to be nothing more than the urine of the fœtus, and this liquid contains a peculiar substance, allantoine. It was therefore to be presumed that the same substance would likewise be found in the urine of the born animal ; and, in fact, I have found it to be an essential and constant principle of the urine of the calf. It has only to be evaporated down to one sixth of its volume to cause the allantoine to crystallize mixed with a considerable quantity of crystallized phosphate of magnesia. To purify and decolorize it, it is redissolved in boiling water, and the solution mixed with a little animal charcoal. The crystals thus obtained, although perfectly white, always affect a different form from that of ordinary allantoine, and which arises from a foreign substance, which can only be removed by combining the allantoine with oxide of silver. On separation from this compound by hydrochloric acid, the allantoine from the urine of the calf does not differ from that obtained from the allantoic liquor or from uric acid either in form or composition. It is $C^8\ H^{12}\ N^8\ O^6$.

The urine of the calf is acid, and contains, besides the allantoine, uric acid and urea nearly in the same proportions as in the urine of man ; but it contains no hippuric acid, an essential constituent of the urine of the cow, which is moreover alkaline and contains no allantoine.—*Comptes Rendus.*

ON THE ESTIMATION OF STARCH.

By H. SCHWARZ.

Krocker's experiments have shown that it is not impossible to convert starch entirely into grape-sugar ; he then determines the amount of sugar produced in Will's apparatus from the quantity of carbonic acid which is evolved during the fermentation. I believe that Barreswil's method of estimating the grape-sugar by means of a solution of copper deserves the preference as regards the time necessary for its execution. For this purpose, a strong alkaline solution of oxide of copper is prepared with the aid of tartaric acid, which prevents the precipitation of the oxide of copper. The best proportions are :—

50 grms. $KO + HO + \overline{T}$
20 grms. $NaO + CO_2$
40 grms. $KO + HO$ dissolved in 200 cubic centim. water.

On the other hand, 30 grms. of $CuO+SO_3+5aq$ are dissolved in 100 cubic centim. water. The two liquids mixed furnish a dark blue liquid, which is filtered and diluted so as to form half a litre.

Supposing us to have pure starch, 10 grms. of it are weighed off after it has been well dried, and converted by boiling with dilute sulphuric acid into grape-sugar ; the liquid is likewise transferred into the half-litre measure, and diluted so as to form 500 cub. centim. Instead of the pure starch, the equivalent amount of cane-sugar (white sugar-candy) can be weighed off and converted into grape-sugar.

10 grms. of starch correspond to 10.555 grms. grape-sugar.

So much of this normal solution of starch is added to 50 cub. centim. of the solution of copper, constantly boiling, until it is entirely decolorized, with formation of protoxide of copper, and the quantity used is noted down. Suppose it, for instance, to require 50 cub. centim., then it corresponds to 1 part of pure starch.

Now, if 10 grms. of flour are treated exactly in the same way, and the solution of starch-sugar produced likewise diluted so as to form half a litre, and then attempt be made to reduce the same 50 cub. centim. solution of copper, I shall now require a much larger quantity, for instance 75 cub. centim. These 75 cub. centim. correspond, therefore, to 1 grm. of pure starch ; the 500 cub. centim. consequently to 6.666 grms. ; the 10 grms. of flour contain consequently 6.666 grms. of $C_{12}\ H_{10}\ O_{10}$, or 66.66 per cent. of starch.—*Liebig's Annalen.*

APOTHECARIES'-HALL.—The following are the names of gentlemen who passed their examination in the science and practice of medicine, and received certificates to practise, on Thursday, August 23 :—Benjamin Webster, Morley-lodge, Leeds ; Rawson Senior, Batley, near Dewsbury, Yorkshire ; John Earnshaw, Clitheroe, Lancashire ; George Burnham, Great Grimsby.

E. Galloway, of Surrey, for certain improvements in paddle-wheels for propelling vessels. Patent dated August 18th, 1835; expired August 18th, 1849.

STATEMENT IN CONTINUATION OF THE ONE PUBLISHED IN THE CHEMICAL TIMES OF AUGUST 25, 1849, SHOWING THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE AIR FROM AUG. 19 TO AUG. 25 INCLUSIVE, AS INDICATED BY THE EVAPORATION OF WATER FROM TWO COPPER VESSELS OR SCALES, ONE INSULATED AND THE OTHER NOT. ALSO THE READING OF THE BAROMETER, THERMOMETER, DIRECTION OF WIND, AND GENERAL STATE OF THE WEATHER.

Aug., 1849.	Barometer.		Therm.		Scales.				Wind.		General state of weather.
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Insulated	Non-Insulated	Morning.	Evening.	
19	30.15	30.25	57	63	10 N.	10 I.	10	10	NE.	NW.	Fine all day, but with large and numerous clouds in the afternoon, indicating that rain had fallen to windward.
20	30.32	30.35	63	65	10 N.	..	..	10	NW.	SW.	Overcast all day, very close, and evaporation excessively sluggish.
21	30.33	30.25	64	68	10 I.	..	10	..	NW.	NW.	Overcast all day; evaporation pretty good.
22	30.20	30.15	66	65	..	..	..	..	SW.	W.	Overcast all day, and very close.
23	30.15	30.13	64	64	5 I.	5 N.	5	5	N.	N.	Overcast morning; rather fine afternoon; overcast evening.
24	30.15	30.13	64	63	5 N.	..	..	5	NE.	E.	Rain at six A.M., but generally fine rest of day.
25	30.10	30.12	65	70	10 N.	30 I.	30	10	SW.	NW.	Generally fine all day.

In my last week's register I referred to the decrease in the electrical condition of the air on the 17th and 18th, and observed that such a change indicated a corresponding change in the weather; and it will be seen that this week the atmosphere has been generally overcast, although the mercury in the barometer has been very high. It will be seen, also, on reference to the daily papers, that the sanguine expectations I expressed in the previous week are actually realized. The health authorities have at last turned their attention to the influence on the constitution of the various gases generated in sewers; hope may, therefore, be entertained that they will soon condescend to a consideration of my principles—196 lbs. of flour, compressed into a cask, increased in weight nearly eight ounces by the compression!

Westminster-road, Aug. 27, 1849. Franklin Coxworthy, Author of "Electrical Condition," &c.

FRANKLIN COXWORTHY'S DISCOVERIES IN NATURAL PHILOSOPHY.

[*Continued from page* 139.]

We endeavoured in our preceding paper to convey to our readers a general idea of the quantity of ammonia that must necessarily be formed by the combination with hydrogen; of the vast amount of nitrogen that is annually liberated from the atmosphere by combustion and respiration; taking as data the fact that, by the combustion of the 35,000,000 tons of coal consumed in this country annually, no less than 380,000,000 tons of nitrogen must be evolved. And as this gas, in its conversion into ammonia, combines with about one fifth of its own weight of hydrogen, or 76,000,000 tons, we have yet to show that there exists good reason for assuming that a bulk of hydrogen passes to the upper regions equivalent to the quantity of nitrogen that must be liberated daily throughout the world. This we shall have no difficulty in doing upon unexceptionable evidence.

In Dr. Silliman's journal for July, 1840, an interesting account is published of the enormous amount of carburetted hydrogen which is generated during the decomposition of vegetable matter in water. Having described the circumstances that induced him to collect and burn some gas which was escaping from a pond in which the students of West-town Boarding-school, Chester county, Pennsylvania, were in the habit of bathing, he goes on to observe that he induced some of the boys to bathe, in the evening, under a promise that he would set the pond on fire without injuring them, and then says:—"The usual preparation for bathing being made, some fifty of the less timid entered the water, with the injunction to step as lightly as possible, till the pond was discovered to be on fire, when all would be at liberty to proceed as would best suit their inclinations. We soon came to a favourable spot, and, the gas beginning to come up pretty freely, a lighted taper was brought near the surface, when in an instant a lambent flame played upon our unprotected bodies, and cast a gloomy light upon the surrounding forest, disclosing here and there, amid the thick underbrush, the pale faces of their shouting companions who remained upon the bank. In the hurry, the injunction to step lightly was forgotten, and the general stir of the leaves which took place extricated the gas in such abundance that the flame rose several feet above our heads. As they separated from me I raised my feet from the bottom, and found it much more difficult to suppress my laughter than to extinguish the flames."

That this gas escapes in large quantities during the decomposition of vegetable matter, the reader may very readily ascertain by filling an ordinary tumbler with water in a ditch containing leaves in a decomposing state, inverting, and then raising, it until nearly lifted out of the water; and, lastly, stirring the muddy water under the tumbler, the gas will be found to ascend in it until the water is entirely displaced.

Those who cannot conveniently make the experiment may prefer the testimony of the distinguished M. Boussingault, who, amongst other statements made by him to the French Academy of Sciences, observes that the decomposition of vegetable matter invariably produces carburetted hydrogen; that this gas arises from all swamps; that it is produced in the greatest abundance under geological circumstances but little known; that near the Canadian lakes there are several burning springs; that in some parts of the United States this gas escapes from the earth so abundantly as to be applied to domestic purposes; that in Italy and Sicily such burning springs also exist; that in Asia the quantity so evolved is prodigious; that, as an illustration, M. Imbert had communicated to M. Humboldt the fact of his having set fire to a stream of gas, issuing from the earth, which produced a flame two feet in height by one in diameter; and that, therefore, putting the ascertained existence of this gas in so many places, and in such immeasurable quantities, with the unexamined portions of the globe, the amount actually liberated must almost baffle computation. Analogy alone can aid us in this instance; and we think we have adduced quite enough to obtain the reader's acquiescence in our conclusions, that the volume of hydrogen liberated from the earth, as a light carburet, is chemically equivalent to the nitrogen liberated by combustion and respiration.

In our next we hope to conclude this portion of the subject—the elucidation of Franklin Coxworthy's two first propositions.

MODE OF SILVERING GLASS BY THE EMPLOYMENT OF GUN-COTTON.

By M. VOHL.

M. Vohl has recently discovered that a solution of gun-cotton in a caustic ley possesses in a high degree the property of precipitating silver from its solutions in the metallic form. In fact, on bringing gun-cotton into contact with a caustic ley of sufficient strength, the cotton will become dissolved in the ley, giving out ammonia with a considerable degree of heat, and producing a deep brown liquid, somewhat thick. On pouring an acid into this, a brisk effervescence is produced, carbonic acid and nitrous acid being disengaged.

The action of the gun-cotton in this instance shows that it is not simply dissolved, but undergoes decomposition, by which the atoms of oxygen in the nitric acid enter into combination with the atoms of carbon in the cotton, thus producing carbonic acid, which, as well as the nitrous acid produced by the nitric acid, combines with 1 part of potash. A fresh decomposition of nitrous salt by the potash, in the presence of hydrogenated substances, furnishes ammonia.

The most remarkable property of this alkaline solution is the following:—On pouring into it a few drops of a solution of nitrate of silver, and adding ammonia until the oxide of silver formed is redissolved (the mixture being slowly heated in a water-bath), the liquid will at a certain period assume a deep brown colour and effervesce, the whole of the silver being precipitated on the sides of the vessel. The mirror thus produced is much superior in brilliancy to those produced by means of ethereal oils or ammoniacal aldehyde; and the facility with which it is produced will doubtless render it of practical importance.

This property is not exclusively possessed by gun-cotton; it is found also in cane-sugar, sugar of milk, manna, gums, and other substances which may be rendered explosive by treating them with nitric acid. Nitropieric acid produces under the same circumstances a reflecting metallic surface; and it appears that this reaction takes place with all bodies which, when treated with nitric acid, do not furnish products of oxidation, but another series of bodies which admit of carbonic acid forming one of their constituent parts.—*Technologiste*; and *Newton's Journal.*

ON THE ATOMIC WEIGHT OF SILICA.

By H. KOPP.

The doubts entertained respecting the atomic weight of silicon and the composition of silica according to one of the three formulæ, SiO, SiO_2, or SiO_3, have not been solved by the views which have hitherto prevailed on this subject, where in general the decision has been made to depend on the circumstance that a particular

series of compounds might be most simply represented, sometimes according to one, sometimes according to the other, formula. A peculiar mode of conceiving this subject shows that, admitting the correctness of the analytical results of Pelouze, the atomic weight of silicon with H=1 is 21.3, and the formula of silicic acid SiO_3.

Kopp has deduced this result from the difference between the boiling-points of the chromide and bromide of silicon. The possibility of deciding the question by this means is sufficiently evident from a number of determinations of the differences between the boiling-points of several chlorides and bromides, in which the chlorine, on the one hand, may be regarded as a substitute for the bromine in the otherwise corresponding bromide, thereby establishing how many degrees the boiling-point rises or falls when in any compound chlorine is replaced by bromine, or, *vice versâ*, bromine by chlorine. After establishing the number of degrees which express this difference for the substitution of each atom of chlorine or bromine, it is possible, on the other hand, to conclude, from the difference between the boiling-points of a chloride and the corresponding bromide, as to the number of atoms replaced. Now, it results, from the comparison of the boiling-points of several bromides and chlorides, that the substitution of 1 Cl by 1 Br raises the boiling-point 32° Cent. of 2 Cl by 2 Br $2\times32=64°$ of 3Cl by 3B3 $\times32=96°$, while the boiling-point falls in the same proportion when, on the contrary, bromine is replaced by chlorine. Compare, for example, the boiling-point of the following substances:—

	Boiling-point.
C_4H_5Cl Chlorethyle,	+11°, Pierre.
C_4H_3Cl Chloracetyle,	—18°to 15°, Regnault.
PCl_3 .. Chloride of phos.,	78°, Dumas, Pierre.

	Boiling-point found.	Calculated.
C_4H_5Br Bromethyle,	41° Pierre	43°.
C_4H_3Br Bromacctyle,	Ord. temp.,	14° to 17°.
PBr_3 ..Bromide of phos.,	175°, Pierre	174°.

Several other comparisons enumerated by Kopp lead to the law above announced respecting the change in the boiling-point in substitutions of bromine and chlorine. It consequently follows, as above stated, that according as the boiling-point of a bromide, on comparison with that of its corresponding chloride, is situated at 32, 64, or 96 degrees higher than in the chlorine compound, this latter must be regarded as containing 1, 2, 3 atoms of chlorine replaced by bromine. The boiling-points of the chloride of silicon and of the bromide of silicon have been determined by Pierre, a most accurate observer, the first to be 59°, the latter to be 153°; the difference is 94°; whence it follows that in the bromide of silicon 3 atoms of bromine are substituted for 3 atoms of chlorine in the chloride of silicon; that the first is $SiBr_3$, the latter $SiCl_3$, and that silica is therefore SiO_3; and consequently we must admit the atomic weight of silicon to be 21.3, H being assumed =1.—*Liebig's Annalen*, lxvii., p. 356, and *Chem. Gaz.*

ON THE PREPARATION OF SUCCINIC ACID FROM MALATE OF LIME.

By Prof. LIEBIG.

The highly important and beautiful observations of Dessaignes on this subject induced me to examine whether the malate of lime might not be converted more rapidly and perfectly into succinate of lime by an ordinary process of fermentation than by the plan proposed by that chemist, and whether an advantageous method of manufacturing succinic acid on a large scale might not be founded upon it.

These experiments have been crowned with complete success. The decomposition of the malate of lime can be effected far more easily and rapidly than the conversion of the lactate of lime into butyrate by employing the same ferment as is used in the butyric acid fermentation. The malic acid is decomposed under these circumstances into succinic, acetic, and carbonic acids.

When to a mixture of 1 part malate of lime and 5 to 6 parts of water the tenth part of the volume of the water of ordinary yeast is added, a pretty lively evolution of gas soon ensues when the mixture is placed in a warm situation. The gas which is disengaged is pure carbonic acid, and is absorbed without the least residue by potash.

After three days an essential change in the form of the malate of lime is perceptible; it becomes granular, heavy, and crystalline, and in the course of the fermentation these granules increase constantly in size. When the fermentation is complete, *i.e.*, when the evolution of gas has ceased, the mixture loses on agitation its muddy condition; the granules appear under the microscope to be composed of stellate groups of transparent needles, which quickly subside like heavy sand when stirred. These crystals consist of a double salt of succinate of lime with carbonate of lime. The supernatant liquid contains acetate of lime.

The formation of succinic acid is effected with equal ease and rapidity by putrefying fibrine or putrefying cheese; the latter is especially adapted for this purpose. The following proportions prove to be most advantageous:—3 lbs. of crude malate of lime, as it is obtained from the expressed juice of the berries of the mountain ash,* after being twice or thrice washed with water, is mixed with 10 lbs. of water at 104° Fahrenheit in an earthen pan, and 4 oz. of putrid cheese, which has been previously rubbed into an emulsion with water, is added to the mixture. When kept between 86° and 104°, a disengagement of gas very soon begins, which continues from five to six days (longer at a lower temperature). In another experiment with 15 lbs. of malate of lime the fermentation was over in four days.

When every sign of fermentation has disappeared, the granular crystalline deposit is collected upon a strainer, washed several times with cold water, and the succinic acid then separated by means of sulphuric acid. For this purpose the crude succinate (and carbonate) of lime is mixed with dilute sulphuric acid until no further effervescence is perceptible, and the quantity of sulphuric acid consumed is noted down. Upon this an amount of dilute sulphuric acid equal to that consumed is added to the paste, and the entire mixture heated to boiling, and kept at this temperature until the granular consistence has entirely disappeared. The liquid is separated from the gypsum formed by filtration through a linen bag, the gypsum washed, and the acid liquid concentrated by evaporation; it contains in solution a mixture of bisuccinate of lime with succinic acid. When it has been so far evaporated that a crystalline pellicle begins to form on the surface, concentrated sulphuric acid is added to it in small portions until no further precipitate of gypsum is formed. In general the liquid congeals to a pasty mass by the newly-formed gypsum; it is diluted with water, and the succinic acid separated by washing. On evaporating the liquid and cooling, a crop of brownish-coloured crystals of succinic acid separates, which contains minute traces of gypsum. This coloured acid is dissolved in boiling water, filtered, set aside to cool, the crystals thrown upon a funnel, and the mother-liquor removed with cold water. The acid obtained by this second crystallization is again dissolved in water, boiled with a little animal charcoal, and the transparent solution crystallized. The crystals are of a dazzling white; they can easily be freed from a trace of gypsum by solution in alcohol or sublimation. 3 lbs. of dry malate of lime furnished from 15 to 16 oz. of dazzling white succinic acid. In my experiments not a trace of malic acid was found in the mother-liquor from the succinic acid; so that in this remarkable process of fermentation the whole of the malic acid is completely decomposed. The process with putrid cheese differs from that with yeast in hydrogen gas being disengaged along with the carbonic acid towards the end of the operation.

Science is indebted to M. Dessaignes for this beautiful discovery, and it is to be hoped that fermentation will come more into use as one of the most powerful agents for chemical decompositions. It is easy to prepare from malate of lime any amount of this interesting but hitherto expensive acid; and a number of useful applications may possibly follow from this discovery.—*Liebig's Annalen* and *Chem. Gaz.*

* In this country the malate of lime might probably be obtained from culinary rhubarb according to the process described by Mr. Everitt.—*Chem. Gaz.*, vol. i., p. 248.

ON THE PREPARATION OF HYDROBROMIC AND HYDRIODIC ACIDS.

By C. H. MÈNE.

Hitherto hydrobromic and hydriodic acids have been prepared by decomposing the phosphurets of bromine and iodine by a small quantity of water. Now, without mentioning the considerable loss of substance, the serious and frequent accidents which occur in this reaction frequently prevent chemists from preparing these gases, and consequently of studying their properties. The means recently proposed, as the essential oil of lemon, or naphthaline, being either rare, expensive, or of difficult preparation, I have considered it of sufficient importance to describe a new method of preparation, which I have recently employed with success, and which presents no danger and is not accompanied by any loss.

To liberate hydrobromic acid gas I employ the crystallized hypophosphite of lime obtained in the preparation of phosphuretted hydrogen from phosphuret of calcium. It is placed in a flask or retort with a small quantity of water; after which I add, by means of a long funnel, some liquid bromine; the reaction takes place instantly, without the assistance of heat, and hydrobromic acid is disengaged, and may be collected over mercury. It is merely requisite to place in the neck of the retort or the flask some pieces of cotton or of amianthus, in order to retain any bromine vapour which might be volatilized by the heat. The reaction of the bromine upon the hypophosphite of lime in presence of water will be easily understood; the water is decomposed, 4 parts of oxygen pass to the hypophosphite of lime, converting it into neutral phosphate, and the 4 parts of hydrogen are transferred to the bromine, forming hydrobromic acid:—

$$4Br + PhO,\ CaO + 4HO = PhO_5\ CaO + 4HBr.$$

To prepare hydriodic acid, I use the same salt and follow the same mode of preparation, only it is requisite to assist the reaction by a little heat. The decomposition is similarly expressed by the equation

$$4I + PhO,\ CaO + 4HO = PhO_5 + 4HI.$$

Sulphite of soda may likewise be employed for the preparation of these two gases. With this salt it is not necessary to add water, as in general the crystals of commerce contain a sufficient quantity; I merely dip them in water, and then add immediately the bromine or iodine. It is necessary to assist the reaction by heat. The reaction is very simple. The bromine or iodine decomposes the water in presence of this salt; 1 equiv. of hydrogen is transferred to the bromine, forming the gas in question, and the oxygen converts the sulphite into sulphate:—

$$SO_2,NaO + HO + Br \text{ or } I = SO_5NaO + BrH \text{ or } IH.$$

It needs scarcely to be observed that the last method is preferable, as the sulphite of soda is commonly met with in commerce, whilst the preparation of the hypophosphite of lime is very troublesome. In the course of two weeks I have disengaged from 20 to 25 litres of these two gases without having met with the least accident; whilst with the old process I have frequently had explosions, which would certainly have produced serious consequences if the quan-

tities operated upon had been at all considerable.

The proportions to be employed for the preparation of these two acids are :—

By the Hypophosphite of Lime.		By the Sulphite of Soda.	
Water	1	Water	1
Iodine or bromine..	5	Iodine or bromine	3
Hypophosphite in crystals	4	Crystallized sulphite of soda ..	6
For 10 parts.			For 10

—*Comptes Rendus.*

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THE CHEMICAL TIMES.

SATURDAY, SEPTEMBER 1, 1849.

THE CHOLERA.

THE columns of the daily and weekly press continue to teem with opinions and suggestions on the causes, nature, and character of the Asiatic cholera, and with recommendations of "infallible" remedies against that fearful visitation. The Board of Health, on its part, continues to publish reports in which it congratulates itself upon the "*success*" with which its measures, regulations, and recommendations have met, and endeavours to show that, if these measures, &c., have not put the cholera completely to flight, this is simply the fault of some refractory boards of guardians, who *will not* do their duty as instructed by the Board of Health. Meanwhile the cholera pursues its career perfectly *unchecked*, and seems to increase in virulence with the number of reports, measures, recommendations, and remedies. Of the latter we have had quite a new batch of late. One ingenious gentleman has taken to the "injection of a hot saline solution into an opened vein of the patient; another has started a mixture of peppermint and turpentine." The following "gem" appeared a few days ago in the *Times*, and in most of the other daily and weekly papers :—

"CURE FOR DIARRHŒA AND CHOLERA.

"The following prescription by Sir James Clark, physician to the Queen, has been administered with perfect success, and saved life :—

"3 drachms spirits of camphor, 3 drachms laudanum, 3 drachms oil of turpentine, 30 drops oil of peppermint.

"For Diarrhœa.—A teaspoonful in a glass of brandy and water.

"For Cholera.—A tablespoonful in a glass of brandy and water.

"The above dose is for an adult. Smaller quantities, according to age, for children."

That a statement of this nature, and which, from the reputation and position of Sir James Clark, could not but be thought likely to exercise considerable influence on the public, should find its way into the columns of respectable journals without due inquiry being made previously into its authenticity, seems hardly credible; and yet such has been actually the case, as the following letter, addressed by Sir James Clark to the editor of the *Times*, will fully show :—

"TO THE EDITOR OF THE 'TIMES.'

"Sir,—The subjoined prescription, purporting to be a cure for cholera, has, I find, been widely circulated in the public journals, and, among others, I believe, in the *Times*, as emanating from me. I shall feel greatly obliged by your permitting me to state that the prescription was never written nor sanctioned by me; on the contrary, I consider it absolutely dangerous in the dose, a tablespoonful (nearly equal to five grains of opium !), in which it is recommended.

"I am, sir, your obedient servant,

"Balmoral, Aug. 26. "JAMES CLARK."

It will be seen that Sir James Clark considers the vaunted "remedy" *absolutely dangerous* at the dose (a tablespoonful—nearly equal to five grains of opium !) in which it is recommended.

We had occasion some time ago to speak in terms of condemnation of the system which has of late obtained in the daily press to give insertion to any plan or suggestion for the treatment of cholera, no matter from what quarter it may happen to proceed. The danger with which such a system is fraught to the public is so apparent that we think we need not dilate upon it here. In illustration we would simply ask, what would be the likely result of a dose of five grains of opium? and, how many people, misled by the name of Sir James Clark at the top of the prescription, may not have been induced to try it? Let our contemporaries ponder upon this: it may render them somewhat more cautious in future.

We still persist in the opinion which we have repeatedly expressed before, that it will generally be found a safer and more successful course to leave the patient to the operations of nature than to try upon him the effects of a purely experimental medication. Considering, however, as we do, the cholera to be a disease of electric origin, we would advise the use of an isolated bedstead for the patient. This has been tried with *real* success by Dr. Pallas and other eminent physicians, and has, at all events, this much in its favour, that it cannot possibly do the slightest harm. A respected contemporary of ours ("The Pharmaceutical Journal") objects to this plan, on the ground that the remedy is quite inaccessible in a majority of cases, and that in most cases the bottles which are intended to act as insulators would scarcely be varnished before the death of the patient. With respect to the accessibility of the remedy, we need simply remark that all that is required to construct an insulated bedstead is a door or large shutter, and four or eight large beer or sherry bottles; nor need the latter be varnished: provided they be perfectly dry, they will answer the purpose equally well unvarnished.

CONTRACTION AND EXPANSION.—From certain experiments made in America by a gentleman of practical scientific research it appears that it is impossible, in countries having a variation of more than 90° F. annual temperature, to construct a coping of stones five feet long in which the joints will be water-tight. Mr. Lyell, proceeding on the calculations arrived at in these experiments, states that, if we can suppose a mass of sandstone a mile in thickness to have its temperature raised 200° F., it would lift a superincumbent layer of rock to the height of ten feet. "But suppose a part of the earth's crust 100 miles thick and equally expansible, the temperature of which was raised 600° or 700°. This might produce an elevation of between 2,000 and 3,000 feet. The cooling of the same mass again might afterwards cause the overlying rocks to sink down again and resume their original position. By such agency we might explain the gradual rise of Scandinavia." Calculations have been made by geologists which appear to account for the elevation of land in Sweden by a rise of only 6.75° temperature (Fahrenheit), supposing the stratum to be 140,000 feet thick. Upon a similar supposition the rise and fall of the waters of the Caspian Sea might be explained, supposing its bed subject to alternate elevations and depression of temperature. Again, if the strata were principally clay, as it is well known that substance contracts when heated, we might account for the subsidence of land on the supposition that the clay strata were contracting under the influence of heat. No one at all acquainted with the enormous, the, in truth, immeasurable, force of attraction and expansion under the influence of caloric will feel a doubt that the cause assigned is at least adequate to the effects produced.

SEMI-GRAVITATING STEAM-ENGINE. — There was exhibited a short time since, before a large party of gentlemen, in Messrs. Scott, Sinclair, and Co.'s foundry here, a novel 6-horse high-pressure steam-engine, constructed to drive a thrashing-mill in the island of Islay. The cylinder receives the steam only at the bottom; it is twelve inches diameter; the piston is solid, twelve inches in depth, and metallic packing; the connecting rod is inserted half into the solid piston, and held by a pin; the upper end is connected to the crank in the ordinary way; that, with the eccentric wheel and strap and fly wheel, are all the trappings on the engine. The connecting road and piston weigh three cwt., and the fly wheel ten cwt.; one half of its circumference is hollowed out with cores in the inside of the rim—the other is entirely solid. This engine will perform the work of any 6-horse power engine, with much less fuel than is commonly used; at the present prices of coal, 1½d. per hour will suffice to keep the necessary supply of steam up in the boiler. The engine stands on a small space, and is constructed at one third less price than the ordinary cost of engines, and so simple that any labourer or peasant may easily attend to it. The engine has been invented, constructed, and patented by our ingenious and enterprising townsman, Mr. John Hastie, foreman to Messrs. Scott, Sinclair, and Co., and the smooth and easy manner it performed its evolutions gave great satisfaction to every person present, who highly commended Mr. Hastie on the success which his skill had attained in simplifying the use of the steam-engine. We have much pleasure in stating that Mr. Hastie is also patentee of the grain-mills which have been for some years in full operation throughout the country.

It was announced when the distribution of prizes was made by his Royal Highness Prince Albert at the Society of Arts, in June last, that the society hoped to be enabled to organize a great national exhibition of manufactures in 1851. We have reason to believe that since that time his Royal Highness, as president of the society, has been actively engaged in devising a plan of an exhibition which shall worthily represent the present manufacturing position of this country. We hear that it is contemplated that, for the first time in the annals of similar institutions, this exposition shall be not national only, but as far as possible universal, embracing the products, machinery, and manufactures of our own country, our colonies, and all nations. It is proposed to give large money prizes and medals, which shall be awarded by a tribunal so elevated above all the interests of competition as to inspire the utmost confidence. The whole undertaking is in some way to have a national sanction given to it, but the taxation of the country is not to be called upon to provide the funds.

WESTERN MEDICAL AND SURGICAL SOCIETY.

Report of the Council, read at the Third Annual Meeting of the Society, April 13, 1849.

Sir B. C. Brodie, Bart., President, in the chair.

The council of the Western Medical and Surgical Society, in presenting their third annual report, rejoice at being able again to express themselves in terms of congratulation as to the progress which the society continues to make. During the past year the number of members has increased, the income has consequently exceeded that of either of the preceding years, and the objects contemplated in the establishment of the society have been advanced with a steadiness and spirit affording the surest promise of continued prosperity.

The council would notice with peculiar satisfaction the increased attendance at the ordinary monthly meetings, and the numerous and interesting communications—embracing a large range of subjects—which have been brought forward. The warmest thanks of the society are due to the authors of these communications for the valuable information they have afforded, and have been the means of eliciting; and while the council entreat them not to relax in their efforts, but to continue the same good offices during the ensuing year, they hope that other members will be induced to follow their example. The obligation to do so is implied in the very act of membership; and the spirit impelling to the fulfilment of this obligation is the vital principle of a society whose aim it is to make the knowledge and experience of every individual available for the benefit of the whole.

In consequence of extraordinary expenditure for furniture, and for carrying out the society's views for the investigation of cholera, less money has been spent in the purchase of books than would otherwise have been the case, or than the council would generally desire. Many valuable books, however, have been added; as, for example, the last editions of the works of Prout, Williams, Watson, and Percira; the Lectures of Professor Owen; Solly on the Brain; Vincent on Surgical Practice; Whitehead on Abortion, &c. &c.; as well as Wilson's Portraits of Diseases of the Skin. To the last-mentioned magnificent work which has just been purchased, to Quain's Plates of the Arteries mentioned in last report, and to Dalrymple's Illustrations of Diseases of the Eye, which they hope immediately to add, the council would direct the attention of the members, as the class of books which it is peculiarly desirable to purchase—works invaluable for reference, but which, by their high price, are beyond the means of most individuals.

They take this opportunity of returning sincere thanks to the members and other gentlemen who have enriched the library with donations during the past year; and again they are called upon to acknowledge the liberality of the Brompton Medical Book Club in depositing for the use of the society nearly twenty volumes of valuable modern works.

With the exception of hospital libraries, intended for students rather than practitioners, and the use of which is limited to the members of the school attached to each particular hospital, there are but two medical lending libraries in London,* and each of these is at such an inconvenient distance from this neighbourhood as to be almost inaccessible to practitioners actively engaged, and therefore, so far as they are concerned, useless. Hence the establishment of a good standard library was put prominently forward from the commencement of the society as one of the chief objects for which it was founded. The council have ever kept this end steadily in view, and, looking at the means at their command, they are rather disposed to rejoice at the progress which has been made than to lament that more has not been done. They are aware that under any circumstances many years must elapse before a library can be collected approaching to completeness, even in a single branch of medical science; but they are anxious that this period should be abridged as much as possible, and they trust that the members generally, acknowledging the great end to be accomplished, will lend their ready and zealous co-operation, by the donation of books, or by depositing them in the library, to be reclaimed at pleasure, as has been done by the Brompton Medical Book Club.

In the apartments occupied by the society during the past year more attention has been paid to the comfort of members using the reading-room than was the case in their former abode. It has consequently been much more frequented. To the journals mentioned in the last report as constantly on the table have been added "The Edinburgh Monthly Journal of Medical Science," and "The London Journal of Medicine." By the liberality of the Registrar-General, the weekly returns, quarterly abstracts, and annual reports are regularly forwarded to the society as soon as published; and the council are under equal obligations to the Board of Health for the prompt transmission of their various reports and official circulars.

By the auditors' report it appears that the funds of the society are in a satisfactory condition. The receipts for the past year have been £92 11s. 10d.; and the expenditure £76 12s. 5d., giving a balance of £15 19s. 5d. in hand. Some inconvenience has been experienced from the subscriptions not being paid up within three months of the annual meeting, as required by the laws. The council are thus kept ignorant of what the year's income is likely to be, and they are precluded from ordering books, and taking other measures to promote the general objects of the society. This remark will, it is hoped, induce the members to comply strictly with the rule for the future.

When, at the beginning of last October, several cases of cholera occurred in rapid succession in the lower part of Chelsea, affording reasonable presumption that the disease in its epidemic and severe form was about to visit this neighbourhood, the society immediately assembled to consider in what way they could best contribute to its further investigation. Convinced that a careful record of cases, and, as far as possible, of every case with an unprejudiced analysis of such records, could alone clear up the obscurity in which the causes of its propagation, its pathology, and its treatment, are involved, they determined to solicit the co-operation of all the resident practitioners, and thus to obtain such records and to make such analysis of cases occurring within their own district. It was further determined to procure the reports, as far as possible, on a uniform and comprehensive plan. A committee appointed to carry out the society's views, after much deliberation, agreed on a form—for the original idea of which they were indebted to Mr. Haden—which was issued by the authority of the society, and of which copies, with a circular letter explanatory of the general objects in view, and requesting the aid of the profession, were distributed to every practitioner in the district, and assurances of co-operation were very generally received.

A hope was entertained that the plan of recording cases thus commenced by ourselves would be carried out by the various London medical societies in their respective districts, and a complete history of the epidemic, as it might manifest itself in the metropolis, thus obtained: such a history, in short, as it has since been suggested in an able article in one of our leading medical reviews should be procured through the agency and interference of the Government. And if this should not be generally done, though we might fail in arriving at that complete history so much to be desired, it was yet believed that even by a limited adoption of our plan, and use of our tables, much good might be effected; and such, the council are glad to see, is also the opinion of the author of the article above referred to, who, alluding to the society's forms, observes, "If only a thousand or two thousand cases could be taken according to this form, the record would give most valuable information." So far as concerns our own district the cases of cholera which have occurred to the present time have been few, and reports of most of them are in the hands of the secretary; and it is satisfactory to know that if the disease should, as appears to be very probable, yet prevail epidemically amongst us,* each practitioner is in a position at once to record his cases on the plan recommended, and that a useful contribution to science will thus be ensured.

The council cannot conclude without expressing, in the strongest terms, their conviction that the employment of such an uniform register of symptoms and treatment in our public medical institutions is imperatively called for, as affording the only means of obtaining data on which to found a correct knowledge of the origin and pathology of cholera, and the laws which govern its appearance and progress. Then, and not till then, can we expect to establish an effectual mode of treatment based on scientific principles; and then, too, we may hope that the columns of our daily journals will no longer be filled with recommendations of "certain cures for cholera," alike empirical, discordant, abortive, and dangerous, although in many instances appearing under the sanction of respectable names.

E. C. Seaton, Hon. Sec.

* Even of these only one is adapted to students and practitioners of the present day. To the library of the London Medical Society, so rich in old books, not 200 volumes have been added since the year 1829.

THE PUBLIC HEALTH ACT AND DISEASES PREVENTION ACT.

A report in small octavo has been issued by the General Board of Health giving an account of the proceedings taken under the Public Health Act, and also those under the Nuisances Removal and Diseases Prevention Act.

The report presents a summary of the proceedings under the Diseases Prevention Act against the prevailing epidemic, which the report prefaces by referring to the warning promulgated by the board in their first notifications, that the track of cholera would in general be the track of typhus, and that these localities must be visited and prepared against the coming of the foreign destroyer. It says:—

"The general result of the adoption of the practical rules which, after the most careful collection of facts, and the widest experience that the time and circumstances permitted, we deemed it our duty to enforce for the attainment of the objects of the Legislature may be thus summed up:

"With reference to the lists directed to be made of the places where cases of fever have been of frequent occurrence, these lists, wherever made out, have guided the guardians and their medical officers, both to the worst places in their respective districts, and to the dwellings of the most susceptible subjects, where the danger was the most imminent, and where the application of the whole system of preventive measures was the most urgently needed.

With reference to the houses of refuge the returns hitherto received have not been sufficiently complete to enable a general summary to be given of the numbers that have been admitted into these asylums, and of the proportion of the individuals residing in them that have been attacked with cholera; but the following is the experience of Glasgow:—There were admitted into the two houses of refuge opened in this city, in all, 806 persons, out of whom twenty-five were attacked with cholera, but only seven died. It must be borne in mind that the whole of these individuals were taken from the most filthy and overcrowded houses, and rooms, in which cholera was actually prevailing, and that if they had been allowed to remain there they would probably have been the next victims. In the houses of refuge they breathed a comparatively pure atmosphere, and they were placed under

* The fear here expressed has since been realized.

proper regimen and strict medical inspection; in the meantime their own houses and rooms, and, as far as practical, the localities immediately adjoining, were thoroughly cleansed and purified. No instances are recorded of any of these persons being attacked with cholera on their return to their own homes.

"With reference to the house-to-house visitation, taken in conjunction with the district dispensaries, which were open day and night, it may be confidently affirmed that by these arrangements the whole of the poor received prompt medical relief, so that, after these arrangements were completed, no individuals perished without medical assistance. Under the system of house-to-house visitation the disease was discovered at its very commencement, and the working of this system tends to establish, among others, the following facts:—

"That, as far as the experiment has been made, the proportion of the diarrhœa to the developed cases ranged from 600 per cent. to 4,000 per cent., this difference arising not so much from any real difference in the prevalence of diarrhœa, as from any greater or less completeness and activity of visitation, by which the existence of diarrhœa was discovered.

"That under this system the proportion of diarrhœal cases which passed into cholera ranged from 1 in 160 and 1 in 260, and in one instance it was only 1 in 298.

"That under this system the mortality of the diarrhœal cases did not in general exceed 1 in 185, while in one instance not a single death occurred out of 1,380 cases.

"That, on the other hand, where diarrhœa was so far neglected that it was not brought under treatment until the evacuations had become serious, and were accompanied with vomiting and cramps, 53 persons died out of every 100.

"The foregoing facts afford *data* for estimating the amount of the saving of life that has been effected by measures which discovered diarrhœa, and which promptly arrested it, and prevented it from passing on to more advanced stages.

"Without doubt, some of these diarrhœal cases, however neglected, would have been checked by the resisting power of the constitution, and would not have passed into cholera; but experience has taught us that, if neglected, great numbers of them do pass into cholera, while, if promptly treated, they are, with few exceptions, arrested at once. The evidence of this is so decisive that the gravest responsibility rests on the local authorities of any district in which cholera breaks out who do not make immediate arrangements for putting into operation the house-to-house visitation.

"But, however encouraging the evidence obtained, and of which we have now given examples, of the efficiency of dealing with this disease in its premonitory stages, still we have, as on a due consideration of the subject might have been expected, received evidence that continued exposure to the predisposing and localizing causes in a high degree of intensity will, in numerous instances, frustrate any remedial measures. Overcrowding, or continued residence amidst damp, and in an atmosphere loaded with impurities, will occasionally counteract all means of prevention. There are some localities from which, as the only security, it is necessary to remove the people.

"We represented, in our first notification, that on account of the intimate connection between the external skin and the internal lining membrane of the bowels, the chief seat of this disorder, the use of warm clothing, and the avoidance of cold and wet, were of much importance during the prevalence of the epidemic, precautions which are as necessary in summer as in winter, it being, indeed, particularly important to guard against the comparative coldness and the occasional dampness of the summer evenings and nights. Our recommendations with respect to diet, founded on the peculiarly irritable state of the mucous membrane of the bowels, so general during the epidemic influence, though at first somewhat questioned by authorities whose opinion is entitled to respect, were yet in accordance with the experience presented to us of all countries where this pestilence has extensively prevailed.

"Our views on these particulars, as well as on the mode of propagation of the disease, have, with some exceptions, been concurred in, both at home and abroad; and we have the satisfaction of knowing that practical measures of prevention, based upon them, where they have been energetically carried out, both in this and in other countries, have produced a manifest effect in checking the progress of the pestilence."

To the important questions which the above statement of the success of preventive measures must suggest, "Why, with such efficient means of prevention, has there been such a severe mortality?" the answer found in the report is the general local neglects of the warnings given. Isolated cases of cholera occur without any visible antecedents, but the statement is repeated in the report, that nowhere has the mortality been excessive in groups of closely connected or contiguous cases without there being found upon the spot causes adequate to account for the excess of the infliction.

By timely attention these aggravating causes might have been removed from the dangerous locality. It was found, however, by the medical inspectors on visiting the localities attacked that the notifications and orders of the board had been neglected, and nothing done, or nothing attempted to be done, until the actual outbreak of the disease. Illustrations of this neglect and disobedience of orders are given in the report, which sets forth that the board had then no powers of their own to enforce them for the protection of the public or to inflict punishment for infractions. The report assumes no weight to the individual opinions of the members of the board, but vindicates its recommendations as the carefully collected results of the experience and preponderant medical experience, not only of this country, but of the whole of Europe. After giving one instance of neglect and infraction of orders, the report states:—

"It appears that this deliberate act of disregard to the orders of the Board of Health was resolved upon on the same evening when the medical officers of the union presented to the guardians a written statement to the effect that malignant cholera had broken out in some parts of the district. Here is an instance of a board, composed for the most part of persons engaged in the daily routine of trade, not having in general, it must be presumed, the means of judging from any large observation or experience of the matter on which they decide, deliberately acting on a medical question against the opinion of their own medical officers, and in direct opposition to regulations framed on the largest experience, not only of this country but of the whole of Europe—regulations so framed for the purpose of carrying out the express provisions of the Legislature."

Besides the cases of ignorance and wilful neglect, the report recites, as causes of obstruction, the separation and conflict of local administrative bodies in several of the afflicted towns. The General Board propose to obtain more unity of acting by making up from representatives of several local bodies one combined local board of health; but the law officers doubted whether the general words of the Diseases Prevention Act gave them such power.

It appears from the report that frequent inquiries were made of the General Board of Health as to what course the householder should take to put the law in motion for his own protection. The following passages from the report comprehend the answers of the board to these inquiries:—

"The local powers for the execution of the law were found to be extremely defective; the authorities for executing them commonly not less so; with divided responsibility frequently conflicting, and wanting in the unity requisite to carry out prompt remedial measures, even when tolerable information existed with reference to them.

"The separation of local administrative bodies in respect to the execution and control of works; the separation of the works for the water supply from the works for sewerage; the separation of the works for sewerage from those for house drainage, and of the whole from those for surface cleansing; the separation of the surface cleansing from the cleansing of sewers and drains, and even, as is sometimes the case, the separation of the cleansing of the main streets from that of courts and alleys; the separation of these and other services, for the consolidation and combination of which the Legislature has provided in the Public Health Act, have seriously impeded the execution of the Diseases Prevention Act.

"The Legislature contemplates the Poor-law Union in England and Wales, with its medical officers, its union-house with its new fever-wards and its provision for medical relief, as the chief local administrative body by which preventive measures could be best carried out; and, in general, it is the most eligible for the purpose. But in towns there are also commissioners of pavements under local acts, who are charged with the duty of surface cleansing as well as paving, who act independently, and who were frequently found to be unwilling to receive directions from the boards of guardians or the medical officers appointed by them. The municipal town councils have, in some instances, the control over the roadways, and they have also under their direction a body of police, whose services are of great importance in the execution of orders, especially where it is requisite immediately to carry out combined regulations. Even where there is a fair and liberal desire to co-operate, on the part of these separate authorities, there has been a serious loss of time in the service of notices, and in framing expositions of the grounds of requests from one to the other. Added to these impediments, the separation affords the means of shifting responsibility from the one to the other.

"Adopting a large remedial interpretation of the terms of the act, 'for taking measures of precaution with promptitude according to the exigency of the case,' we had contemplated the issuing of regulations for carrying these provisions into effect, as we believe the Legislature would have done, had there been laid before it the special circumstances of the case, by forming special boards of health, composed of members of the town councils, of the boards of guardians, and of the paving boards, who might give united directions to their officers. The law officers, however, were of opinion that the general terms of the statute could not be so constructed as to authorize a combination of the local authorities, with a view to bring their united powers to bear in the manner we proposed. The regulations were, therefore, carried out chiefly by the separate powers of the boards of guardians, with the voluntary co-operation of the municipal or other authorities; but, at the best, with the inconveniences of delay from the separate action. Had it been possible to combine the various authorities, as at first contemplated, a far greater unity and efficiency would have been ensured both in England and Scotland.

"In the metropolis, the multiplicity of the paving boards, some parochial and others not, charged with the duty of surface cleansing and the removal of refuse, has also been productive of considerable inconvenience, since it has prevented answers being given or directions issued until these acts could be sought out and the powers and duties provided under them ascertained.

"The following reply from the General Board of Health to an inquiry from the Rev. W. Dodsworth, the incumbent of Christ Church, Regent's-park, as to 'what he should do in order to effect the cleansing and draining of his parish,' in other words, what was the local law under which the parishioners were living, is illustrative of a very common obstacle to prompt,

efficient, and economical local administration:—

"'The General Board take the opportunity to state that they have received applications similar to your own from householders, inquiring what steps they may take to obtain the removal of that refuse or to ensure proper cleansing, and what is the actual law and the state of its administration for sanitary purposes within their respective parishes, and what they, as householders, may do for its enforcement or aid. The General Board have been prevented giving early replies, as well as eventually satisfactory ones, by the excessive variety of the provisions of the numerous local acts by which the objects have been sought to be attained.

"'The work of surface cleansing is, in many cases, performed by bodies of various descriptions, under the authority of local acts. The jurisdiction of the authorities constituted under these acts are as various as their powers. It is one of the topics of the local inquiries, directed by the Legislature to be instituted under the Public Health Act, to ascertain upon the spot what the local acts are, what are the bodies constituted under them, and how the powers so conferred are executed. Unless the General Board itself is informed upon these points, it is unable either to apply its own orders with the particularity which is requisite, or to give such information as that which is now sought.

"'The number, condition, and action of the bodies constituted by the local acts is one object of investigation by the metropolitan sanitary commissioners, and they have been hitherto unable to complete that inquiry.

"'There appear to be upwards of one hundred and twenty local acts for the more dense portions of the metropolis, for the management of upwards of eighty distinct local jurisdictions, many of which coincide neither with parish, nor union, nor police district, nor any other recognised division. When a householder, who gives his address in a particular street, applies to know how he may proceed—if the local act be sought out, and the provision in relation to the matter in question be also sought out—he cannot always be safely answered, inasmuch as streets are frequently divided, sometimes longitudinally, and paved and cleansed at different times under different jurisdictions. At present no public maps are known to exist by which the area of the jurisdiction could in any such cases be ascertained correctly.

"'In the parish of St. Pancras, where you reside, there are no less than sixteen separate paving boards, acting under twenty-nine acts of Parliament, which would require to be consulted before an opinion could be safely pronounced as to what it might be practicable to do for the effectual cleansing of the parish as a whole.

"'The General Board of Health can only state in answer to such applications, that the information sought can be obtained by no other means than local inquiry; and they hope that this will be done on behalf of householders by the parochial board acting under the general directions of the Board of Health now issued.'

"The following extract from a letter by Mr. Payne, the coroner of the city of London, displays the consequences of these defects; and the inconveniences and evils here represented will, we hope, be diminished by the consolidations provided for by the Public Health Act:—

"'The first child was attacked ten days ago, and died last Sunday; the second was attacked on Tuesday morning last, and died in the afternoon; and the third since then; and two more were very ill from the same cause.

"'The father of two of the children had not complained to anybody except his landlord, because, he said, he did not know the state of the law. The medical officer reported it to the clerk of the board of guardians on Saturday last; and Mr. Simon, the officer of health, said that no report had been made to the guardians till Thursday morning last, which he thought a great neglect in the clerk to the board.

"'I found that the police constable, whose attention was drawn to the nuisance on Tuesday, reported it to his sergeant, the sergeant to the inspector, the inspector to the commissioner of police, and the latter to the commissioners of sewers.

"'All this roundabout mode of doing business I deprecated as injudicious, and suggested that it would be desirable if the inmates of the courts and alleys were informed that they might complain directly to the inspector of nuisances for the district, whose duty it would be in such case to see to it immediately.

"'There is every reason to believe that some of these lives would have been saved if the matter had been properly made known in the first instance.'

"Theoretically, it is supposed that all the inhabitants are best acquainted with the state of their local law, and take an interest and part in its administration. Practically, their knowledge of it, in busy towns, is generally found to be such as that displayed in the above extracts; and resistance to local consolidation and simplification arises from the active canvassings of office-bearers, and persons pecuniarily interested in the administration, rather than from any spontaneous desire on the part of the great body of the population. The advantages, for the sake of efficiency and despatch, of uniform local procedure, and administrative arrangements, have been pointed out before, but they are strongly re-enforced by the disastrous delays recently experienced.

"The law gives to this board no power to originate prosecutions for neglect or violation of its orders and regulations, and, therefore, we have no direct control over guardians, whatever course they may adopt with reference to the orders of the board, in consequence of which those orders have been, to a considerable extent, deprived of the authority which it was the intention of the Legislature to give to them, and which they must possess to accomplish that object fully."

THE HEALTH OF LONDON DURING THE WEEK.

[From the Registrar-General's Return.]

In the week ending Saturday, August 25, the deaths in London were 2,457; of which 1,276 were by cholera, 238 by diarrhœa. The deaths from all causes in each of the last seven weeks were 1,070, 1,369, 1,741, 1,931, 1,967, 1,909, 2,229, 2,457; the deaths from cholera, 152, 339, 678, 783, 926, 823, 1,229, and 1,276. Although the number of deaths last week is greater than any number yet recorded, it is gratifying to learn that active measures are now in actual operation, or commencing in every district, to combat the great epidemic which has already destroyed 7,470 lives in London. The mortality stands in favourable contrast to that which has been felt in other cities where the visitation has recalled the ravages of the middle ages. But, if the general sanitary state and arrangements are superior to those of the other civilized countries of Europe, it is quite certain that, while the present epidemic has excited some talk and terror, the efforts which have hitherto been employed to combat it look feeble and insignificant when contrasted with the vast means and agency which are brought to bear by the nation in other fields for protection of life and property.

The energy with which parts of our institutions work makes the defects of the rest more evident. On August 9 last a man was murdered in Bermondsey, and before his death, reported by the coroner, will appear in these returns, one and it is probable both the persons charged with the murder will be in custody. Steam-ships, the electric telegraph, the heads of the police, and professional agents, specially chosen, were all employed to arrest the destroyers of this life; the columns of the newspapers were filled with the details of the death. On the same day (August 9) a stockbroker died at No. 12, Albion-terrace, Wandsworth-road; a widow lady, and an old domestic servant, at No. 6; in the five preceding days in the same terrace the daughter of a grocer, a child of five years of age, had died at No. 1; the widow of a coach proprietor, and a commercial clerk, at No. 2; a gentleman's widow at No. 3; a surgeon's daughter at No. 4; a spinster of 41 at No. 5; the wife of a dissenting minister, his mother, a widow lady, and a servant, at No. 6; a young woman of 21 at No. 10; a gentleman at No. 12, where the stockbroker died; a commercial clerk and a young woman of 19 at No. 13, where a young woman also died, on July 28; a gentleman's wife at No. 14, who had seen her daughter die there the day before. The 19 persons died of cholera; many of the inhabitants of the terrace were dispersed; and the deaths of several have been registered elsewhere. "It appears," says the registrar, Mr. Frost, "that at No. 13, inhabited by Mr. Biddle, where the first death occurred, and where two deaths were afterwards registered, the refuse of the house had been allowed to accumulate in one of the vaults (which is a very large one) for about two years, and when removed last week the stench was almost intolerable, there being about two feet of wet soil filled with maggots. The drains also had burst, overflowed into the tank, and impregnated the water with which the houses were supplied. On the back ground, in the distance, was an open ditch, into which nearly the whole soil of Clapham runs." As turpentine to flames, so is the exhalation of such cellars, tanks, and sewers to cholera; it diffused itself rapidly, attacked many, and nineteen inhabitants, after some hours of suffering, sickness, and spasms, expired.

The effects of decomposing refuse and water on health were well known—their fatal subsidies to cholera had been heard of every day; yet no steps had been taken for their removal from Albion-terrace in July, no medical police had interfered to disturb the contents of Mr. Biddle's cellar; and now the nineteen,—masters, servants, parents, children,—rest in their graves, it appears to be taken for granted that blame attaches to nobody—to nothing—to the householders themselves—to the guardians of the district—to the institutions of the country! Such mean intangible instruments of death can be invested with no dramatic interest; but, fixing our eyes on the victims, it is well worth considering whether substantially it is not as much a part of the sound policy of the country that lives like those in Albion-terrace should be saved, as that the murderers of the man in Bermondsey should be hanged.

The revelations of the state of their districts in the registrars' notes of this and last week prove that it will be no easy task—I say, not to stay the plague of cholera, for it will subside—but to remove the evils which make cholera and all epidemics fatal. The vast task of the physical amelioration of the population demands the energies of the best men in her Majesty's dominions. When, in the country from which Asiatic cholera came, our armies seemed for a moment worsted, and the empire threatened, the great captain of the age is reported to have addressed to another the memorable words, "If you do not go, I must." That enemy was distant. We have one very near, in our streets, of which cholera, a servile minister, has destroyed already 7,470 lives in London, and thousands more in the rest of the kingdom. Who will go out against this enemy? Is it too powerful or too feeble for the arm of the greatest? Will no glory crown its conquest? Is the country insensible to its magnitude? Will not all the national strength and resources be put forth to improve the hygienic condition of the people, and to rid England of the causes of the fatality of epidemics? This may yet be done by the Government, aided by the force of facts and of enlightened public opinion.

Boiled linseed oil and red lead, mixed so as to form a thin paste, make a good cement.

THE CALIFORNIAN GOLD MINES.

[To the Editor of the *Times*.]

Sir,—Perhaps you will think it worth while to insert the following observations on the subject of California and its gold-teeming soil.

The want of correspondence between the magnificent reports of the produce of the workings and the actual arrivals of the precious metal indisposes people to believe that these will ever reach a point to create any disturbance in the relative value of property in this country. I should be glad to entertain the same opinion, but with my eyes open to all the facts of the case, I cannot but believe that we are on the eve of a most important revolution in the value of our present circulating medium.

I give you the following observations for what they are worth. If they serve only to direct the attention of the public to this interesting subject so as to help us to form a just estimate of our future prospects in connection with it, they will have done some good.

I will observe, first, with regard to the small quantity of gold yet received, that this proves nothing. Last summer there were only 3,000 persons at the workings, many of whom are dispersed over the world with the produce of their labours in their pockets, not yet telling in a public way in the market; then winter came, and after it a long rainy season, so that up to the last date, although there were, perhaps, little short of 100,000 workmen ready to take the field, the waters had only subsided sufficiently to afford space for a few of the most enterprising to commence operations.

The next three or four months will see the whole host at work, and the aggregate produce of their labour must be very large; but great as it may be, it will probably prove insignificant compared with what it will be when a systematic mode of working is introduced.

To understand the subject properly, it is necessary to study the *locale* in the only map which we have hitherto received, which is probably very imperfect. The Sierra Nevada is a long range of mountains, from which flow into the rixer Sacramento ten or more tributary streams, and into the river San Joachim seven. In the beds and on the banks of every one of these streams are found gold deposits in strata in various depths.

This general distribution of the metal proves that the whole face of the Sierra is richly impregnated with it, and that by the disintegration of the Quartz Rock which forms its matrix a fresh supply, forming a new stratum, is carried down with every winter's flood. Now, giving credit to Mr. Lyell's theory, that certain geological effects in parts of America which he explored have required for their production the continued atmospheric influences and action of nearly 100,000 years, is it not possible that for a large portion of this term the Sierra Nevada may have been pouring its riches into the beds of the abovenamed two rivers?

It may appear at first sight that the weight of the metal would arrest its course *in transitu*, but although this might be the case with the heaviest lumps, as by far the greatest portion of gold it found in laminæ or thin flakes, the bulk of these must have been carried down by the winter torrents into the beds of the great rivers, and thus an enormous deposit of this precious metal will probably be found where the tributary streams run into them.

And in this case how to get at it? This will easily be done by establishing screw-propelled iron steamers on the rivers furnished with dredging apparatus to raise the soil where the gold is most likely to be found, and supplied also with every utensil and vessel necessary for separating the gold and melting it into ingots. These vessels might be at constant work winter and summer; best in winter, as there would then be water enough to carry them a good way up most of the tributary streams. Can it be doubted that such an undertaking, in addition to the workings of 100,000 aspirants for wealth at the dry diggings, would produce gold enough to unsettle its relative value? And, in addition to this apparently inexhaustible field, namely, in the vicinity of the two-named rivers, gold has been found on the river Gila, at the head of the Mexican Gulf, 600 miles south of the present workings, and also in the neighbourhood of Cape St. Lucas, 600 or 700 miles still further south, the extreme southern point of the Californian peninsula, in latitude 22 deg. (see "Travels" of G. Shelvocke, in Kerr's edition of "Voyages and Travels," vol. ii., page iv.) It may be said, that admitting the utmost success that could attend the Californian workings, the quantity of gold in circulation is so large that such an addition could have no appreciable effect on its value. This is an egregious mistake, however. It will hardly be believed that the whole quantity of gold currency in the world, taking it at its usual estimate of 150 millions sterling, would only weigh about 1,150 tons, and that in bulk a room 20 feet long, 12 feet wide, and 10 feet high, would hold it all.

I have only one more observation to make. It may be asked how it happens that the recent discovery of gold in California can be capable of producing an effect so different from anything that has yet been experienced. Gold mines have often been discovered before, and energetic measures taken to render them productive, and yet the world jogs on without perceiving any difference. But the present state of things is entirely without a parallel. Never has it yet happened that a whole country side has been found strewed, as it were, with the precious metal, and attainable in abundance by individual enterprise and exestion. With the exception, I believe, of the gold dust imported from Africa, the only sources of supply at present are the product of mines for the most part deep in the bowels of the earth, and worked by the aid of powerful machinery, the veins meandering in threads and scales, and rarely extending themselves into sheets, through primitive rocks requiring to be blasted. I believe this to be the case with the celebrated mines in the Ural Mountains, where, notwithstanding that the power applied to their exploitations is, no doubt, limited only by the extent and capabilities of the field, yet the average annual preduce for the last ten years amounts, by official returns, only to £3,400,000 sterling.

Wandsworth-common, Aug. 27.

DOVER'S LONDON SEWAGE MANURE PROCESS.

On the 22d ult. we had the pleasure of witnessing an interesting and conclusive experiment performed upon a quantity of fluid taken from the great sewer in Northumberland-street, Charing-cross, illustrative of the mode of treatment of the sewage of London proposed by Mr. Richard Dover, of New-street, Spring-gardens, with the double intention—first, of procuring from it a fertilizing manure; and, secondly, of depriving it of those substances injurious to animal life which it holds in solution or mechanical suspension.

To this important subject Mr. Dover appears to have devoted considerable attention, and by dint of experiment and reflection he has succeeded in discovering a disinfecting agent, by the judicious operation of which both these objects may be effected.

The result of the experiments at Spring-gardens, which are intended to exhibit on a small scale the larger operations necessary to purify the sewage of a town, shows in a very satisfactory manner that these two purposes, however incongruous they may appear to be, are, nevertheless, within the reach of modern chemistry. As the apparatus is exceedingly simple, the main point of the process lying in the disinfecting or "de-putrifying" agent, as Mr. Dover terms it, the entire operation may be described in a few words. The water from the sewer, in quantity about a gallon, was thrown into a glass vessel, into which a small portion of the disinfecting agent had been poured. After the lapse of a short interval a sediment began to form at the bottom of the receiver, and the supernatant fluid was allowed to flow off by a glass tube communicating with the vessel, the discharge being controlled by means of a cock ground into it. The tube is bent into the form of the letter C with square corners, and terminates in a small filtering apparatus, containing animal charcoal, closed at the bottom, where the tube is connected with it, and open at the top, over which a piece of canvas is firmly stretched. The fluid descending from the receiver above percolates through the canvas, and filtration takes place by ascent. The resulting fluid, which would exhibit the presence of free acid on application of any of the tests, is perfectly free from smell of any kind, and, though not colourless, is not contaminated by any nauseous taste.

The matter precipitated in the receiver by the action of the disinfecting agent is collected upon a cloth, and after undergoing a process of exsiccation, or drying, yields a dark-coloured granulated substance, to which the name of "British Guano" has very properly been given. A large sample in bulk was exhibited to us by Mr. Dover, to which we applied the test universally practised in trying real Peru guano, being that of rubbing it in the hands, which it did not discolour or soil.

The above experiment, which was satisfactory in the extreme in producing the result above mentioned, exhibits, on a small scale, the operation of actual practice, which is this:—The contents of a sewer at any convenient point are diverted by a dam, revolving bulkhead, or partition, capable of falling down when a greater hydrostatic pressure is exerted against it than that which would be produced by a high tide, so that there can be no danger of an overflow. They then fall into a well or cistern, whence they are pumped into a series of tanks by means of a steam-engine, the fluid filling them successively. Here the disinfecting agent does its work, the residuum is collected at the works, and the floating fluid escapes into the river, deprived of all those impurities which at present render it a source of disease. If the sewer be a large one several of these works may be constructed upon it; and in that case the channels will be so constructed as to carry off from the first works the fluid which it cannot act upon, and send it to the second. From the second the excess would flow to the third, and so on, until it would finally enter the river. Much may be said upon the process at its several stages, but it will be sufficient here to state that the late experiment was conclusive upon the correctness of the principle; and, as to the efficiency of the manure thus produced, it may be mentioned that it has been tried with the most complete success in various parts of the country by various agriculturists.—*Patent Journal.*

LIGHTHOUSE LAMPS AND REFLECTORS.

A very interesting experimental trial of the powers of several lighthouse reflectors took place on the evening of Friday, the 17th ultimo, at Woolwich, under the direction of the Trinity-house, and, we believe, at the request of the Board of Admiralty. The lamps and reflectors tried were those in ordinary use by the Trinity-house, and two others on plans of the invention of Mr. A. Gordon. The Trinity-house lights, manufactured by Messrs. Wilkins, of Long Acre, are used in nearly all the lighthouses of the kingdom; the reflector is parabolic in form, and the one tried was 22 inches in diameter and 9 inches in depth; the lamp, of the Argand construction, at $3\frac{1}{4}$ focal distance. One of Mr. Gordon's apparatus consisted of a reflector of the hyperbola form, 22 inches in depth, and 19 in diameter, with Argand lamp at $1\frac{1}{8}$ focal distance; and the other of Mr. Gordon's lights has, in addition, four annular glass refractors. The lamps were lighted at half-past eight, on

the upper story of the Royal Marine Barracks, and the power of the lights directed to the village of Rainham, in Essex, a distance of about 6½ miles, at which place the gentlemen to whom was confided the task of reporting on the efficiency of the respective apparatus were assembled. We understand that among the distinguished party were Admiral Sir Charles Malcolm, G.C.B., Rear-Admiral Beaufort, Captain Hamilton, R.N., Captain Bethum, R.N.; and Captain Bax, R.N., Captain Farrar, R.N., Captain Madan, R.N., elder brethren of the Trinity-house. It appeared to be the almost unanimous opinion of the witnesses of the experiments that the Trinity-house light was the best on the whole; for, although Mr. Gordon's lens apparatus was certainly equal to the other when seen in a direct line, it was inferior when tried at an angle of 7° of divergence from the line of observation; and that without the lens was not equal in any point of view to the ordinary reflectors. The cost also, we are informed, would be in favour of the parabolic reflector. The experiment gave much satisfaction to those present, and it was not till a late hour that the party left the quiet village of Rainham for London.

The importance of having the very best lights for lighthouses must be obvious to all, and it cannot but be satisfactory to the Trinity-house authorities to know that their efforts to procure the best light apparatus have not been void.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Charles Frederick Whitworth, of Hull, gentleman, for improvements in preventing accidents on railways. Patent dated February 17th, 1849. Enrolled August 17th, 1849.

This invention has reference to apparatus for the purpose of providing greater security in railway travelling, and which is intended to act in case of any neglect of duty on the part of the engine-driver, either from his inattention to signals, or to the cutting off the steam from the engine at such times as it is proper for him so to do. This improved apparatus, the patentee observes, is very similar to an apparatus which has been before used for cutting off the steam from locomotive engines, but which has hitherto acted as an assistant to the engine-driver, and contributed to render him more careless of his duty, from the fact of the apparatus performing the functions designed for him in case of his neglect to keep a good look out ahead, and promptly to obey the signals given, whereas, according to this adaptation, it not only performs the intention of such signals as require the steam to be cut off, but, at the same time, registers the omission against him, and this in each successive case of neglect on his part to perform such operation. The lever used for actuating the signal-post, so as to elevate or exhibit a signal, is mounted on a shaft, placed transversely under the rails, having mounted on it two cams, which, when the signal is raised, also elevates two levers, placed at the side of the rail, so as to assume an inclined position. On the tension-bar, between the axle-guards, are placed two separate sets of apparatus, one in connection with the lever-arm on the steam-whistle, and the other with a throttle-valve in the steam-passage to the cylinders. A rod is pendent from each, which, as the carriage passes the spot where the inclined levers are placed, and being carried forwards up the incline, thereby actuates the lever of the steam-whistle, and also the throttle-valve before mentioned, by which the steam is turned on to the whistle, and cut off from the cylinders, should such not have been previously performed by the driver. The action of the incline upon the steam-whistle is simply to move the crank-arm of the stopcock, which is the same as under the command of the driver, and which, when turned off by him, replaces the parts moved by the incline, so as to be again acted on in a similar way; the apparatus employed for cutting off the steam turns a stopcock in a similar manner, but in this case admitting steam to a small horizontal cylinder, the piston-rod of which is in connection with the crank-arm of a throttle-valve rod, in the steam-passage, which is thus caused to revolve with its axis, and to cut off the steam. In connection with this spindle a hand on a dial is moved by means of a ratchet and click, so that (at each separate turn the steam being cut off by this apparatus) the hand shall move through one space of a graduated scale, and thereby indicate the number of omissions on the part of the driver. When the driver obeys the signal given, and turns off the steam by means of the regulator, it actuates the lever, which passes up the incline, so as to cant it up, and thereby places it beyond the reach of the incline, so that, in the event of no neglect taking place on his part, no indication will appear on the dial-plate before mentioned. When the steam is cut off by the incline, a spring catch enters a notch in a quadrant on the regulator, so as to retain it, and prevent its being turned until the parts are returned to their original position, which is performed by a foot lever under the command of the driver. When the several parts are returned to their position, the steam is admitted to the reverse side of the piston in the small cylinder, and allowed to escape from the other by the reverse movement of the steam-cock, when the index-plate and throttle-valve will also be in position to be acted upon by the stationary incline. By these arrangements the driver is compelled to place the parts in a position to be acted on as described, in order to obtain the command of the regulator of his engine.

The second improvement consists in the adaptation of a longitudinal sliding rack, placed under each carriage, and actuated by a pinion on a transverse shaft, worked from the side of the carriage; the rack has a fork hook attached to it, which, when projected at the end of the carriage, is hooked on to one of the joints of the coupling; the carriages are then drawn together by means of the pinion moving the rack, by which the buffers will be drawn up hard, so as to bring up the unhooked loop of the coupling over the hook of the rack carriage, and in such a position as to be easily dropped on to it; the rack-hook is then released, when the steam comes on the coupling as usual; by this means the dangerous necessity of getting between the carriages is obviated.

No specific claims are appended to this specification.

John Erwood, of Hoxton, in the county of Middlesex, paper-hanging-manufacturer, for improvements in the manufacture of paper-hangings. Patent dated February 15th, 1849. Enrolled August 15th, 1849.

This invention relates to improvements in that class of paper-hangings known as coloured marble and granite papers, and such as are used for covering walls in houses and other buildings. In using the term "coloured marble papers" it is to be understood to mean all coloured marble papers, with the exception of those manufactured in imitation of white marbles.

In the manufacture of marble and granite papers there are two modes of operation pursued in the application of the colour to paper, to give it the desired effect, one of which is by means of blocks, having engraved surfaces, by which the colour is printed or transferred on to the paper; and the other mode of manufacture s by applying the colours by hand, by means of brushes and crayons, the veining and other effects required being executed according to the taste and skill of the workman. Both of these modes of proceeding being well known, it is unnecessary to describe them further, the present improvements having reference to the hand-made marble and granite papers, or those in which the colour is applied with brushes and crayons, by hand. To coloured marble or granite paper-hangings it has, hitherto, been usual to apply a coating of varnish after they have been hung or pasted to walls, in order to give them the glossy or polished appearance of the polished materials of which they are an imitation, the colours used in the manufacture of such papers producing only a dull representation of the effect desired; whereas, according to the patentee's new manufacture of marble and granite papers, the colours are so prepared and applied to the paper as to be capable of receiving the desired gloss or polish in the ordinary manner of glossing or polishing papers known under the denomination of "satin" papers, and by which the necessity of varnishing the paper, after it is hung, is entirely obviated, the paper, when so finished, presenting the same glossed or polished appearance as if it had been varnished.

In conducting this new manufacture of coloured marble papers the patentee proceeds in a somewhat similar manner to the ordinary mode of manufacturing hand-made papers. The paper to be operated upon is previously prepared with a coating of colour as a groundwork, the colour used being suitable for the colour of the ground of the paper. The piece of paper so treated having been properly dried is then laid out on a board, with the coloured surface uppermost, and the workman proceeds to give it a coating of the matter known in the trade as "satin-white," or it may be satin-white mixed with a colour: this is applied to the whole surface of the paper, by means of brushes, in the ordinary manner. He then proceeds to delineate the marble on the moist or wet surface of the paper, produced by the application of the satin-white, and, by preference, putting on what is called the veining first, which is performed with the ordinary crayons, the colours of which are suitable to produce the veining required for the character of the marble. This veining is next softened off by the ordinary softening-brush, in order to blend the colour of the veining slightly with the groundwork or coating of satin-white, so as to break the harshness of the outline; the colours are then applied while the satin-white is still in a moist or damp state, introducing them with brushes, in the ordinary way, in imitation of the kind of marble or porphyry to be represented. These colours are then smoothed down, or subdued and blended with the ground or coating of satin-white. Thus it will be seen the whole of the colours, with the exception of the preparatory coating mentioned, are introduced while the satin-white is still wet, after which the paper will be complete, as far as regards the effect to be produced by the colouring matter, when it may be dried in the ordinary manner. The colouring matters used are the same as those employed in ordinary in the production of marble papers; but instead of being prepared simply as water-colours used in the ordinary manufacture of hand-made marble papers they are prepared with a proportion of satin-white, that the colour shall also present a surface capable of receiving the polish or gloss to be imparted to it. In manufacturing granite papers according to this invention the patentee also employs paper previously prepared with a coating of colour as a groundwork, which, while in a dry state, receives a coating of satin-white, coloured or otherwise, it being laid out on a board, as before described with reference to marble paper, while this coating of satin-white is yet in a moist or damp state; he then proceeds to apply the colouring matter in imitation of granite in the ordinary manner, by splashing or otherwise causing the colour to adhere in spots to the satin-white. This operation being common in the manufacture of granite papers, further description will be unnecessary.

The colours used in splashing in imitation of granite are also prepared with a proportion of satin-white, in order to render the colours of the constituent proportions necessary to produce the desired effect, by rubbing or polishing, as will be hereafter described. It is not necessary that the colour used as the preparatory coating should contain any satin-white, either for the marble or granite papers. Marble and granite

papers, when prepared in this manner, after having been thoroughly dried, are then subjected to the process known in the trade as "rubbing," for the purpose of imparting the desired gloss or polish; the machine known as a "rubbing machine" is employed for this purpose; being in ordinary use for rubbing satin papers, it will not require minute description; suffice it to say that it consists of a cylindrical brush, of a sufficient length to operate upon the whole width of the paper. This brush is caused to rotate rapidly, and during such rotation to bear against a surface or table, between which and the brush the paper is passed, having the marbled side of the paper next the brush; the marbled surface of the paper is previously dusted or rubbed with French chalk, in a state of powder, as a polishing material. The end of the paper having been introduced between the brush and the table, the rotary motion of the former draws in the paper from the roll, which is supported so as to unroll freely, yet taking care that a sufficient amount of friction is exerted on the paper as it passes over the table, to prevent its too rapid passage under the brush. The paper, as delivered from this machine, is in a finished state, presenting the glossed or polished appearance required on the marble or granite surface.

Having described the nature of his invention, the patentee wishes it to be understood that he does not confine himself to the precise mode of conducting the different parts of the manufacture, so long as the peculiar character of the invention is retained. That what he claims is—The manufacture of hand-made marble and granite papers, in which a coating of satin-white is employed as a groundwork or surface, on which to delineate the marble or granite, as described; and also the application of colours having a proportion of satin-white mixed therewith, in this manufacture, in order to produce a surface to the marble or granite paper capable of being glossed or polished.

Charles Thomas Pearce, of Park-road, Regent's-park, Esq., for improvements in apparatus for obtaining light by electric agency. Patent dated February 16th, 1849. Enrolled August 16th, 1849.

1. Mr. Pearce employs, like preceding speculators in this branch of applicate science, a disc of carbon, but applied at an angle to the edge (not the point) of a bar electrode, and the disc is made to revolve by the same clockwork which winds up the bar electrode. Sometimes more than one disc is applied to prevent the going out of the light. The bar electrode is supported by three platinum wires tipped at their upper ends with iridium, and which conduct the electricity to near the point where the light is produced. The bar electrodes are sometimes composed of pieces of different lengths joined together with dowels of the same substance as the electrode is made of. And, sometimes, the patentee uses two pieces of charcoal, of a non-conducting nature, for preventing the two electrodes from coming together. These two pieces of charcoal are pressed forward against the upper end of the lower electrode by means of helical springs, thereby occupying a place somewhat between the two electrodes; and it is supposed that thereby the electrodes will be kept at the proper distance to maintain the light.

2. To produce contact between the electrodes in the event of the light going out, the current maintaining the light is made to pass through a double coil, with an armature connecting them at one end, which armature is connected to the end of a small beam. When the current is not flowing through the coil, the armature is drawn up by means of a spring attached to the beam. The other end of the beam carries a piece of carbon, which in the raised-up state of the armature comes between the electrodes, completes the contact, and produces the light, at which moment the armature is drawn down upon its place, and brings back the beam to its original position.

3. A third improvement consists in causing clockwork, together with the battery and the arrangement of the electrodes, above described, to produce an intermittent light. One of the wheels of the work, through which the current flows, is pierced on its periphery with ivory or wood, which, for the space of time the ivory or wood is in contact with the end of a conductor (forming part of the circuit for the current), prevents the flow of the electricity, and, consequently, for that time, the light is extinguished. A similar means is employed for periodically bringing into use and stopping the action of any or all of a series of batteries employed for producing light.

4. A fourth improvement is in the application of a permanent and an induced magnet so combined that, together with the aid of wheelwork, the current of electricity shall be regulated.

5. A fifth improvement has reference to perfluent batteries, but the difference (if any) between Mr. Pearce's and those of Mr. Staite, to which the patentee alludes, is very little. Mr. Pearce makes his copper plates sometimes of a corrugated or zigzag form, so as to increase the surface; he also uses the muriate of ammonia, and prefers to excite the action of alkaline salts.

Claims.—1. The producing of light at the edges of bar electrodes instead of at the points. Also, the combination of bar with disc electrodes, when the discs are applied at an angle to the bar electrodes. Also, the conducting supports to the bar electrode. Also, the preventing contact of the electrodes by means of a non-conducting substance. And, lastly, the manner of uniting the pieces forming the electrode.

2. The manner of renewing the flow of the current of electricity when the light has been put out.

3. The employment of clockwork to regulate the times of duration of the light, and also the employment of clockwork to regulate the times the batteries are kept in and out of action.

4. The apparatus composed of the permanent and induced magnetic bars for regulating the flow of electricity.

5. The perfluent or sustaining batteries above described.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING AUGUST 23, 1849.

Charles Cowper, of Southampton-buildings, in the county of Middlesex, for improvements in machinery for raising and lowering weights and persons in mines; and in the arrangement and construction of steam-engines employed to put in motion such machinery, part of which improvements are applicable to steam-engines generally. Patent dated August 23d, 1849; six months. (Communication.)

Frederick Chamier, of Warwick-street, in the county of Middlesex, commander in the Royal Navy, for improvements in the manufacture of ships' blocks. Patent dated August 23d, 1849; six months. (Communication.)

William Edward Newton, of London, civil engineer, for certain improvements in steam-boilers. Patent dated August 23d, 1849; six months. (Communication.)

Alfred Vincent Newton, of London, mechanical draughtsman, for improvements in manufacturing and refining sugar. Patent dated August 23d, 1849; six months. (Communication.)

LIST OF PATENTS WHICH HAVE PASSED THE GREAT SEAL OF SCOTLAND, FROM THE 21ST DAY OF JULY, TO THE 22D DAY OF AUGUST, 1849, INCLUSIVE.

James White, of Lambeth, in the county of Surrey, civil engineer, for improvements in machinery or apparatus for sowing seed. Sealed July 25th, 1849; six months.

James Green Gibson, of Ardwick, near Manchester, in the county of Lancaster, machinist, for certain improvements in machines used for preparing to be spun or spinning cotton and other fibrous substances, and for preparing to be woven and weaving such substances when spun. Sealed July 30th, 1849; four months.

Andrew Peddie How, of the United States, but now residing at Basinghall-street, in the city of London, engineer, in the United States navy, for an instrument or instruments for ascertaining the saltness of water in boilers. Sealed August 1st, 1849; six months. (Communication.)

Hugh Lee Pattinson, of Washington-house, Gateshead, in the county of Durham, chemical manufacturer, for improvements in manufacturing a certain compound or compounds of lead, and the application of a certain compound or certain compounds of lead to various useful purposes. Sealed August 6th, 1849; six months.

Amadée François Remond, of Birmingham, for improvements in machinery for folding envelopes, and in the manufacture of envelopes. Sealed August 6th, 1849; six months.

Richard Kemsley Day, of Stratford, in the county of Essex, hydrofuse-manufacturer, for improvements in the manufacture of emery paper, emery cloth, and other scouring fabrics. Sealed August 7th, 1849; six months.

John Thom, of Ardwick, near Manchester, calico-printer, for improvements in cleansing, scouring, or bleaching silk, woollen, cotton, and other woven fabrics and yarns when printed. Sealed August 7th, 1849; four months.

Joseph Findlay, of New Sneddon-street, Paisley, in the county of Renfrew, North Britain, manufacturer, and Andrew Wilkie, of the same place, turner, for an improvement or improvements in machinery or apparatus for turning, cutting, shaping, or reducing wood or other substances. Sealed August 10th, 1849; six months.

James Thomson Wilson, of Middlesex, chemist, for improvements in the manufacture of sulphuric acid and alum. Sealed August 15th, 1849; six months.

Edward Lord, of Todmorden, in the county of Lancaster, machinist, for certain improvements in machinery or apparatus applicable to the preparation of cotton and other fibrous substances. Sealed August 15th, 1849; four months.

Pierre Armand le Comte de Fontainemoreau, of South-street, Finsbury, for certain improvements in weaving. Sealed August 22d, 1849; four months. (Communication.)

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF IRELAND, FROM THE 21ST DAY OF JULY, TO THE 21ST DAY OF AUGUST, 1849, INCLUSIVE.

Thomas Robinson, of Leeds, in the county of York, flax-dresser, for improvements in machinery for breaking, scutching, cutting, hackling, dressing, combing, carding, drawing, roving, spinning, and doubling flax, hemp, tow, wool, silk, and other fibrous substances, and in uniting fibrous substances. Sealed August 7th, 1849; six months.

John Edward Hawkins Payne, of Great Queen-street, in the county of Middlesex, coach-lace-manufacturer, and Henry William Currie, engineer, in the employ of the said John Edward Hawkins Payne, for improvements in the manufacture of coach-lace, and in other similar looped or cut-pile fabrics. Sealed August 7th, 1849; six months.

PATENTS RECENTLY EXPIRED.

W. Johnston, of Tipton, gentleman, for certain improvements in the construction of boots and shoes. Patent dated August 22d, 1835; expired August 22d, 1849.

W. Lucy, of Birmingham, miller, for certain improvements in steam-engines. Patent dated August 24th, 1835; expired August 24th, 1849.

T. Schwartz, of Stockholm, technologist, for a practical application, or practical applications, of known principles to produce mechanical power.

Patent dated August 24th, 1835; expired August 24th, 1849.

WENHAM LAKE ICE.—The work of cutting and storing the ice is carried on in winter, and is not commenced till the ice is at least a foot thick; the surface is always carefully swept and kept free from snow; and, as none but the most compact and solid ice is fit for the market, it is necessary to shave off three inches or more of the superficial ice, by means of a machine called an ice plane, drawn by a horse. This operation is especially required after a thaw or a fall of rain, succeeded by a frost, which causes the lake to be covered with opaque porous ice. Sir Francis Head, in his "Emigrant," 1846, has attributed the durability of Wenham Lake ice, or its power of resisting liquefaction, to the intense cold of a North American winter. It is perfectly true that this ice does not melt so fast as English ice; but the cause of this phenomenon is, I believe, very different from that assigned for it by the late Governor of Upper Canada. "People in England," he says, "are prone to think that ice is ice; but the truth is that the temperature of 32° Fahrenheit, that at which water freezes, is only the commencement of an operation that is almost infinite; for after its congelation water is as competent to continue to receive cold as it was when it was fluid. The application of cold to a block of ice does not, as in the case of heat applied beneath boiling water, cause what is added at one end to fly out at the other; but, on the contrary, the centre cold is added to and retained by the mass, and thus the temperature of the ice falls with the temperature of the air, until, in Lower Canada, it occasionally sinks to 40° below zero, or 72° below the temperature of ice just congealed. It is evident, therefore, that if two icehouses were to be filled, the one with Canada ice and the other with English ice, the difference between the quantity of cold stored up in each would be as appreciable as the difference between a cellar full of gold and a cellar full of copper; that is to say, a cubic foot of Lower Canada ice is infinitely more valuable, or, in other words, it contains infinitely more cold than a cubic foot of Upper Canada ice, which again contains more cold than a cubic foot of Wenham ice, which contains infinitely more cold than a cubic foot of English ice; and thus, although each of these four cubic feet of ice has precisely the same shape, they each, as summer approaches, diminish in value; that is to say, that each gradually lose a portion of their cold, until long before the Lower Canada ice has melted the English ice has been converted into lukewarm water." There can be no doubt that where an intense frost gives rise to a great thickness of ice, permitting large cubic masses to be obtained after the superficial and porous ice has been planed off, a great advantage is afforded to the American ice-merchant, and the low temperature acquired by the mass must prevent it from melting so readily when the hot season comes on, since it has first to be warmed up to 32° Fahrenheit before it can begin to melt. Nevertheless, each fragment of ice, when removed from the storehouse, very soon acquires the temperature of 32° Fahrenheit; and yet, when a lump of Wenham ice has been brought to England, it does not melt by any means so readily as a similar lump of common English ice. Mr. Faraday tells me that Wenham Lake ice is exceedingly pure, being both free from air bubbles and from salts. The presence of the first makes it extremely difficult to succeed in making a lens of English ice which will concentrate the solar rays, and readily fire gunpowder, whereas nothing is easier than to perform this singular feat of igniting a combustible body by the aid of a frozen mass if Wenham ice be employed. The absence of salts conduces greatly to the permanence of the ice; for where water is so frozen that the salts expelled are still contained in air cavities and cracks, or form thin films between the layers of the ice, these entangled salts cause the ice to melt at a lower temperature than 32°, and the liquefied portions give rise to streams and current within the body of the ice, which rapidly carry heat to the interior. The mass then goes on thawing within as well as without, and at temperatures below 32°; whereas pure and compact Wenham ice can only thaw at 32°, and only on the outside of the mass.—*Lyell's Second Visit to the United States.*

PHILLIPS'S FIRE ANNIHILATOR.—On Friday, the 24th ult., a number of very interesting experiments were made at the London Gas Company's Works, Vauxhall, with this ingenious and remarkable invention. These were preceded by an explanation from Mr. Phillips of the manner in which he was led to the discovery, and of the principles upon which its success depends. He stated that, while watching a volcanic eruption in the Mediterranean, he observed that the huge column of water which was discharged from the crater did not extinguish the flame which accompanied it, while the smoke of a brushwood fire swept by the wind put out another brushwood fire near it. He exemplified the little power of water in extinguishing flame by several very simple experiments, and he then introduced the "fire annihilator," and at once put out very large fires fed with the most combustible materials. The extraordinary speed, ease, and certainty with which the invention acted, in all the trials to which it was put, excited the warm admiration of many gentlemen of high scientific attainments who were present; and there can be little doubt that the "patent fire annihilator" is a very valuable addition to the discoveries of the age. In construction and application it has the great advantage of being extremely simple, being quite portable and capable of being placed where it would be most accessible in cases of emergency. The gases which it evolves, and which are found so efficacious in extinguishing flame, are produced from a compound of charcoal, nitre, and gypsum, which again is ignited by breaking a glass bottle containing sulphuric acid. The acid drops upon chlorate of potass and sugar, and instantly a large body of vapour is evolved with great force from a tube connected with the copper or metal chamber in which the whole materials are enclosed. This vapour extinguishes flame with a rapidity which is truly marvellous, and by it Mr. Phillips appears to have arrived at the simplest and most certain means of effecting a large saving in the immense annual loss of property and life by fire in this country. That loss is calculated to amount in property to £2,000,000. A company has, we understand, taken up the invention, and we have no doubt that it will soon supersede the long rows of buckets, filled with water, with which the corridors of our public buildings are now so often garnished.

THE LONDON CLAY.—It will be recollected that at the first court, held on the proposed tunnel of Mr. Phillips, Dr. Buckland asserted unequivocally "that there was not an atom of London clay between Rotherhithe tunnel and the base of Shooter's-hill," and that "it glanced off at the north-east corner of St. Paul's." Since that time evidence of the most satisfactory nature, and from unquestionable authority, has been obtained that it does exist, and in large quantities, in places altogether denied in the speech of Dr. Buckland, as will be found in the following statement:—At Greenwich marshes, opposite Blackwall, 55 feet of London clay; near the London Dock and St. Katharine's Dock, 55 feet; at Bermondsey, 55 feet; near London-bridge, 130 feet; and, extending upwards, it was found at Lambeth, 160 feet; at Westminster, 170 feet; at Kensington, 170 feet; and at Brompton, 237 feet; and for a considerable distance above London-bridge the bed of the river is cut in the blue clay.—*Builder.*

THE GENERAL BOARD OF HEALTH.—The new act for confirming certain provisional orders of the General Board of Health, and for other matters relative to the Public Health Act and the improvement of towns and populous places (12th and 13th of Victoria, cap. 94), will speedily be enforced. Provisional orders relating to Taunton, Worcester, Ware, Sheerness, Kendal, Durham, Leicester, Chatham, New Windsor, Carmarthen, Gloucester, Lancaster, Croydon, Uxbridge, and Coventry, are confirmed. Elections for local boards of health are appointed to take place in the course of the present month. By the 8th section local boards of health, constituted under the Public Health Act, are authorized to contract, for any period not exceeding three years at any one time, with any company or person for the supply of gas or oil, or other means of lighting the streets, roads, and other places of their respective districts, and may provide lamps and other materials, and the expenses shall be defrayed out of the general or special district rates levied under the said Public Health Act. This act is to be incorporated with the Public Health Act, 1848, and to be called "The Public Health Supplemental Act, 1849."

TO CORRESPONDENTS.

"P. F., Denton."—1. M. Deville has not yet made any further communication on the subject to the Academy. 2. The manganocyanide of potassium may be prepared by dissolving protocyanide of manganese in a solution of protocyanide of potassium. 3. Generally the Centigrade, but sometimes Baumé's (for dense liquids) and Cartier's (for light liquids).

"G. H. P."—To prepare a beautiful, transparent, colourless tracing-paper, it is best to employ the varnish formed with Damara resin. The sheets intended to be rendered transparent are laid flat on each other, and the varnish is then spread over the uppermost sheet by means of a brush until the paper appears perfectly colourless, without, however, the liquid therein being visible. The first sheet is then removed, and hung up for drying; the second and the other remaining sheets are treated successively in the same way. After being dried, this paper may be written on with chalk and pencil, or steel pens. It preserves its colourless transparency without becoming yellow, as is frequently the case with tracing-paper prepared in any other way; it is, moreover, cheap, and its preparation gives very little trouble. To your second question we will reply next week.

"R. P. S."—Leroy's vomitif-purgatif is prepared as follows:—Take of finely-pulverized tartar emetic, one drachm; white wine, one half pint; sugarcandy to colour. Dissolve, and label the bottle "Vomitif." Next dissolve seven drachms of resin of jalap in half a pint of alcohol, and label the bottle "Purgatif." We strongly advise our correspondent not to use this nostrum. We look upon it as decidedly dangerous.

"A Druggist."—You have rendered yourself liable to a penalty of £10.

"Mr. Whitman, Newcastle."—Ure's madder lake is prepared as follows:—Take of ground madder, two pounds; water, one gallon; mix, and stir the mixture for about ten minutes; after this, strain off the water, and squeeze the grounds quite dry. Repeat the same process a second and a third time. Pour the products of the three operations together, and add three quarts of water, and half a pound of alum. Heat the mixture in a water-bath for three or four hours, adding water as the liquid evaporates. Filter first through flannel, and subsequently, when sufficiently cold, through paper. Add to the filtrate a solution of carbonate of potass as long as a precipitate falls, and wash this precipitate till the water comes off colourless. Dry the thoroughly-washed precipitate. If the alkali be added in three successive doses, three different lakes will be obtained, successively diminishing in beauty.

"M. C."—We beg to decline.

"A Patentee."—You had better consult Mr. Barlow (of the *Patent Journal*). We are not sufficiently acquainted with the *law* of the case to give you the desired information and advice.

"Mr. Richard Dyer, Manchester."—At Birmingham.

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ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXXII.

(LECTURE CV.)

VEGETO-ALKALIS—(*Continued*).

VERATRIA.

JERVINA—COLCHICIA.

The discovery of veratria is due to MM. Caventou and Pelletier. These chemists discovered it in the course of an analysis of divers plants belonging to the family of the Colchicaceæ. They stated it to be present in the Veratrum sabadilla, Veratrum album (white hellebore), and Colchicum autumnale (meadow saffron). Some other plants of the same family, having an analogous action to that of the white hellebore and meadow saffron, may be assumed to contain the same principle. Thus Veratrum nigrum has the same properties (and no doubt also the same composition) as the white hellebore. The root of the Veratrum luteum, of the United States, appears to exercise a somewhat less energetic action on the system than that of the white and black hellebores; according to Dr. Dana this root is extensively used in the States as a simple emetic. The bulbs of Erythronium americanum and of Erythronium indicum have also emetic properties; but their composition is not known. Pallas tells us that in Siberia they eat the bulbs of Erythronium dens canis.

More recent researches have shown that the veratria in the Veratrum album is accompanied by another organic base, viz., jervina; and that the organic base in the meadow saffron is not veratria, but colchicia.

The formula of veratria is, according to M. Couerbe's analysis:—

$$C_{34}\ H_{23}\ N_1\ O_6.$$

It has a resinous appearance. It is white, pulverulent, and uncrystallizable. Its taste is excessively acrid. It acts with singular energy on the membrane of the nose, the minutest dose of it exciting violent sneezing. Taken internally in very small doses, it brings on the most fearful vomiting. Frictions with veratria on the skin produce local heat, succeeded by a peculiar sensation which Dr. Turnbull compares to that excited by electricity; but neither eruption nor vesication ensues.

Dr. Turnbull has exhibited veratria internally in nervous disorders. It produces heat, and a kind of nervous tremor in the fingers; these symptoms are succeeded by a sensation of general coolness all over the body.

Veratria fuses at 239° Fahrenheit. It is not volatile. It is very sparingly soluble in water, requiring 1,000 times its weight of boiling, and a still larger quantity of cold, water for solution. It is very soluble in alcohol, and dissolves also with tolerable facility in ether. It saturates acids, and forms with them crystallizable salts (at least with the hydrochloric and sulphuric acids).

Veratria is best prepared from Veratrum sabadilla. The process is as follows:—Reduce the seeds of the plant to a coarse powder, and digest this with alcohol at 36°. Pour off the alcoholic tincture obtained, and digest the grounds again with alcohol of the same strength. Pour off the tincture, and repeat the same operation once more. Add the product of the second and third digestion to that of the first, distil off the alcohol, and evaporate in the water-bath to the consistence of an extract. Boil this in water, and strain through a bolting-cloth. Boil the grounds once more in pure water, and strain. Boil the grounds now in acidulated water, strain, and boil once more in acidulated water. Pour the liquid products together, add animal charcoal to the fluid, and heat the mixture. Filter, and concentrate the filtrate. Add to the concentrated liquid caustic magnesia, which will throw down the veratria. Collect the precipitate, and remove the moisture from it by squeezing. Concentrate the mother liquor again, and treat once more with magnesia. Collect the precipitate, and add it to that obtained in the preceding operation. Dry the magnesian precipitate, and, when dry, treat it with alcohol until the soluble part is dissolved out. Evaporate the alcoholic solution to dryness. Boil the extract obtained with acidulated water; add animal charcoal, and filter. Concentrate the filtrate, and finally precipitate the concentrated liquid with ammonia.

This is M. Couerbe's process. That of the Codex differs from it in the following points:—The alcoholic extract is boiled simply in pure water; the liquid is precipitated, in the first instance, with acetate of lead; the liquors are subsequently precipitated with ammonia, and the precipitate is redissolved in alcohol. The alcoholic solution being evaporated to dryness, the residue is treated with ether, which dissolves the veratria, leaving the resinous matters undissolved. The veratria is then decolorated by solution in sulphuric acid, and the use of animal charcoal.

The veratria obtained by these processes is not pure. It contains a black pitchy matter, a crystallizable alkali, insoluble in water and in ether (sabadillina), a species of brown resin insoluble in ether, and possessing some alkaline properties (the French chemists call this substance vératrin), and a solid, uncrystallizable, alkaline substance, soluble in water (gum resin of sabadillina). According to Simon, the sabadillina of Couerbe is a compound of veratria, resin, and soda.

Veratria is exhibited internally, though more frequently externally, in nervous disorders. In cases of rheumatism, where it is desired to excite perspiration, the salts of veratria are preferred to the alkali.

ALCOHOLIC TINCTURE OF VERATRIA.

Take of Veratria, 10 centigrammes.
Alcohol at 88 Cent. (34° Cartier), 16 grammes.
Dissolve.—(Magendie)
Dose, a few drops.

This tincture is intended as a substitute for the alcoholic tincture of colchicum.

TURNBULL'S EMBROCATION OF VERATRIA.

Take of Veratria, 1 part.
Rectified alcohol, 16 parts.
Dissolve.

TURNBULL'S DROPS OF VERATRIA.

Take of Veratria, 1 part.
Rectified alcohol, 64 parts.
Dissolve.

Dr. Turnbull introduces this solution into the meatus auditorius.

VERATRIA PILLS.

Take of Veratria, 5 centigrammes.
Gum arabic,
Syrup of gum, of both a sufficiency.
F.S.A. ten pills.—(Magendie.)

Magendie exhibits these pills as a purgative, at the dose of three pills a day.

Dr. Turnbull's pills consist of five centigrammes of veratria and twenty centigrammes of extract of hyoscyamus, which quantity is divided into ten pills.

SOLUTION OF VERATRIA.

Take of Sulphate of veratria, 5 centigrammes.
Distilled water, 64 grammes.
Dissolve.
Dose, a teaspoonful at a time.

VERATRIA POMATUM.

Take of Veratria, in powder, 20 centigrammes.
Hogslard, 32 grammes.
Mix.

Magendie recommends frictions with this pomatum in gout and dropsy; M. Calvé recommends it in neuralgias. M. Sauvan asserts that this pomatum, to act effectively, must be prepared with rancid hogslard.

VERATRIA LINIMENT.

Take of Veratria, 2 grammes.
Olive oil, 4 grammes.
Hogslard, 32 grammes.
Mix.

Dr. Turnbull recommends frictions with this liniment in nervous disorders and rheumatism. According to Dr. Cunier's judicious observation, the veratria ought to be dissolved in alcohol or in ether previous to its intermixture with the fatty substances.

IODURETTED VERATRIA LINIMENT.

Take of Veratria, 1 gramme.
Ioduret of potassium, 1½ gramme.
Hogslard, 32 grammes.
Mix.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON THE ATOMIC WEIGHTS OF CERIUM, LANTHANIUM, AND DIDYMIUM.

By C. MARIGNAC.

In the first part of this memoir* I stated that it was easier to obtain the oxide of cerium contained in the mixture of the oxides extracted from cerite in a state of purity, by treating it first with very dilute nitric acid, and then with a more concentrated acid, which deprives it of the last traces of lanthanium and didymium. By following an analogous process the oxides of the two last metals are obtained free from cerium, by evaporating to dryness the solution effected by very dilute acid, calcining the residue, and digesting it afresh with nitric acid diluted with at least two hundred times its weight of water; but the separation of these two oxides presents quite another difficulty. It is well known that the process discovered by M. Mosander to accomplish this separation is founded on the difference in solubility of the sulphates of these oxides at different temperatures. Both are very soluble in water at 41°-43° Fahrenheit, and are for the greater part precipitated by a higher temperature. But the sulphate of lanthanium is already precipitated from a concentrated solution at a temperature below 86°, whilst the sulphate of didymium still remains almost entirely in the liquid, and is only separated at a higher temperature. This property allows of obtaining at last perfectly pure sulphate of lanthanium, provided that a sufficient quantity of salt is operated upon to be able to repeat this operation a considerable number of times.

It is necessary, therefore, after having converted the oxides into sulphates, to calcine the latter at a dull red heat, in order to render them anhydrous, to pulverize them, then to convey them gradually into from five to six times their weight of water, taking care to agitate the liquid continually, and to keep it immersed in water at 32°, in order to avoid the considerable elevation of temperature, which would otherwise result from the hydration of the sulphates. The solution is then filtered, and kept for several hours at a temperature between 86° and 95°. The sulphate of lanthanium is precipitated in minute colourless crystals, and the solution has a rose colour from the sulphate of didymium. The liquid is decanted, the crystals washed on a funnel with a little water, then calcined, and the operation repeated. It will be understood that in each operation some sulphate of lanthanium remains in the liquid and in the wash-water, so that the weight of the product rapidly diminishes in proportion as its purity increases. The first crops of crystals of the sulphate of lanthanium, when viewed in mass, still exhibit a faint rosy tint; the subsequent crops appear colourless; but, if the solution from which the salt has crystallized is evaporated to dryness, the residue is rose-coloured, indicating that there was still a little sulphate of didymium present. Now this treatment must be continued until the residue left on evaporation is itself perfectly colourless. I

* Page 3 of the present volume.

think, when this has been attained, we may be certain of the purity of the sulphate of lanthanium; at least I have found that the salt now deposited by the first elevation of temperature and that obtained on evaporation to dryness have exactly the same appearance and furnish the same equivalent.

Thus the purification of the sulphate of lanthanium may be accurately attained by this process; it merely requires patience and a sufficient quantity of material. Unfortunately this is not the case with the sulphate of didymium, which is left in the solutions mixed with sulphate of lanthanium. When these solutions are submitted to a slow evaporation between 104° and 122°, they deposit large crystals of sulphate of didymium, of a bright rose colour, mixed with a large quantity of minute crystals of a lighter rose colour, and which are probably more contaminated with lanthanium. Now, the most perfect crystals in form and colour should be carefully selected, and this separation by crystallization several times repeated; in this operation patience and a quantity of material are indispensable. In each operation a purer product is obtained, but we have no means of ascertaining its purity.

I have unsuccessfully attempted the use of a number of reagents, trying their action on the mixed oxides, or by causing them to act separately on each of the two oxides. I have not been able to discover the least difference which might lead to the detection of a more accurate process of separation, or even quicker than that above described, and which is nothing more than Mosander's.

I will nevertheless mention two processes, which, without leading even to an approximative separation of these two oxides, appear to me capable of being usefully applied in the treatment of their mixture, when they are in such relative proportions that the crystallization of the sulphates no longer furnishes any result.

If these sulphates are converted into oxides, either by precipitating them at different intervals by carbonate of soda at a boiling temperature or in any other manner, and if, after having strongly calcined these oxides, they are left in contact for a very long time at the ordinary temperature with a very large amount of water containing nitric acid, but not in sufficient quantity to dissolve the whole, a very slightly-coloured solution is obtained rich in oxide of lanthanium; whilst the residue, dissolved in its turn in nitric acid, furnishes a more highly-coloured solution, and which is, consequently, richer in didymium.

Another process is founded on a slight difference of solubility of the oxalates. Both are very insoluble in water, and very sparingly soluble in dilute acids, so that these oxides may be almost entirely precipitated by oxalic acid from their neutral sulphuric and muriatic solutions. If the oxalates thus precipitated are heated with a large quantity of muriatic acid diluted with its volume of water they are completely dissolved, and are subsequently precipitated by the evaporation of the liquid; but we then observe that the first precipitates are more rose-coloured than the last, so that we may by this means obtain a mixture containing more oxide of didymium, and another mixture containing more oxide of lanthanium.

These two processes, it will be seen, do not effect even an approximate separation. I employed them merely to obtain a mixture rich in didymium, capable of being purified by conversion into sulphate and crystallization.

Pure sulphate of lanthanium is perfectly colourless; it most frequently crystallizes in small, slender, and very short acicular prisms. It may, however, be obtained in determinable crystals, although very small, by spontaneous evaporation; they are hexahedral prisms, terminated by a six-sided pyramid, like quartz. The minuteness of the crystals renders the measurements difficult; however, all my observations agree in proving the angle of the prism not to be 120°, but only 119° 30′; the primitive form, therefore, is a right rhombic prism. This salt contains three equivalents of water of crystallization, like the sulphate of cerium.

The sulphate of didymium is of a somewhat deep and pure rose colour; it crystallizes readily in very brilliant and sometimes tolerably large crystals, which belong to the oblique rhombic prism. The crystals are frequently mackled parallel with the anterior angle of the prism; they are easily cleavable in the direction of the base. The faces of the primitive rhomboidal prism are not met with; but a large number of modifications are observed, among which I shall especially mention the oblique rhomboidal octahedron (d_1, b_1), and the usual truncations on its front edge (o_2) and on its posterior one (a_2). The following are the principal angles:—

		°	′
Inclination of the axes P on h_1	.....	118	8
Angles of the octahedron	on the front edge d_1 on d_1	78	48
	on the posterior edge b_1 on b_1	54	12
	on the lateral edge b_1 on d_1	143	49
Inclinations of the base P	on the faces d_1 ...	125	20
	on the faces b_1	110	3
	on the faces o_2	155	40
	on the base a_2	138	49

This salt likewise contains three equivalents of water of crystallization. It is remarkable that the sulphates of these three oxides, notwithstanding the great analogy which they exhibit in all their properties, and their containing the same proportion of water of crystallization, are nevertheless not isomorphous. Those of cerium and lanthanium, it is true, belong to the same system, that of the right rhomboidal prism; but their angles do not allow of their being connected one with the other.

I shall now proceed to the determination of the equivalents of the salts.

Atomic Weight of Lanthanium.—I first followed for the analysis of the sulphate of lanthanium the method which I have described for that of the sulphate of cerium, which is based upon the mutual precipitation of this salt and the chloride of barium, and on the employment of normal solutions. The same difficulties occur as with the sulphate of lanthanium; an inspection of the results obtained appears even to indicate in the present case greater uncertainty; not only is there frequently a much greater difference between the two limits which should comprise the true equivalent, but I have not obtained perfectly constant results in several successive experiments, even on operating on the product of one and the same preparation. The following, however, are the results:—

	Sulphate of Lanthanium.	Chloride of Barium.		Equiv. of Sulphate of Lanthanium.		
		Min.	Max.	Max.	Min.	Mean.
1.	11.644	12.765	12.825	1185.8	1180.3	1183.0
2.	12.035	13.195	13.265	1185.7	1179.4	1182.5
3.	10.690	11.669	11.749	1190.9	1182.8	1186.8
4.	12.750	13 920	14.000	1190.7	1183 9	1187.3
5.	10.757	11.734	11 814	1191.8	1183.7	1188.7
6.	12.672	13.813	13.895	1192.6	1185.8	1189.2
7.	9.246	10.080	10.160	1192.4	1184.3	1188.3
8.	10.292	11.204	11.264	1194.2	1187.8	1191.0
9.	10.192	11.111	11.171	1192.5	1186.1	1189.3

It is evident that some of the results differ too much from the mean to be free from error, and it is advisable in calculating this mean to omit the experiments 1, 2, and 8; we then obtain the number 1188.3. I have endeavoured to check this result by following a slightly different process, which appears to me to be applicable under various circumstances.

I accurately dried and weighed off very nearly equivalent quantities of sulphate of lanthanium and chloride of barium, taking care to have a slight excess of the latter. I then used a solution of the chloride to precipitate the acid of the first salt, following in every respect the ordinary rules for estimating sulphuric acid, only that I subsequently mixed the filtered liquid and the whole of the wash-water, and evaporated it down to a very small bulk; and then, by adding a few drops of sulphuric acid, precipitated the baryta which had remained in excess in the decomposition of the two salts. The sulphate of baryta obtained in this second operation was collected, washed with care, and dried. Knowing the weight of the chloride of barium employed, the quantity of sulphate of baryta corresponding to it can be calculated; and, if we deduct from it the weight of the sulphate obtained in the second precipitation, the difference expresses the weight of that which ought to have been precipitated by the mixture of the two saline solutions. If we compare this weight with that furnished by direct experiment, the latter is always found to be too high, however long the washing may have continued; and it is easily ascertained that this mass of sulphate of baryta contains a notable quantity of lanthanium, by treating it after calcination with hydrochloric acid. It will be understood that the error resulting from this mixture should be at least proportional to the weight of the sulphate of baryta obtained; and that consequently this error is diminished at will by making the weight of the total mass of this sulphate depend on that of the slight precipitate obtained in ascertaining the excess of baryta left in the filtered liquids and the wash-waters of the first precipitate. Two experiments made according to this method gave:—

Sulphate of Lanthanium.	Chloride of Barium.	Sulphate of Baryta.			Equiv. of Sulphate of Lanthanium.
		1st pre.	2d pre.	Calculated.	
4.346	4.758	5.364	0.115	5.329	1187.4
4.733	5.178	5.848	0.147	5.803	1188.3

By combining these results with those obtained by the other method, and with which they agree very well, we find that the number 588 may be admitted to represent very approximately the equivalent of lanthanium.

The determinations hitherto made of this equivalent exhibit great variations, thus:—

M. Choubine has adopted the number			451.88
M. Rammelsberg	"	"	554.88
M. Mosander	"	"	580
M. Hermann	"	"	600

My results come very near to those of M. Mosander. M. Hermann, denying the existence of didymium, did not separate it from lanthanium, which must have raised its atomic weight beyond the true number.

Atomic Weight of Didymium.—As stated above, I have not been able to find any means of detecting the presence or absence of lanthanium in the sulphate of didymium. I shall therefore confine myself to enumerating the results of the determinations of the equivalent of this salt made upon several samples obtained after repeated crystallization. They were made according to the method last described:—

Sulphate of Didymium.	Chloride of Barium.	Sulphate of Baryta.			Equiv. of Sulphate of Didymium.
		1st pre.	2d pre.	Calculated.	
3.633	3.902	4.412	0.084	4.373	1210 4
3.862	4.227	4.679	0.075	4.662	1206.9
3.330	3.552	4.027	0.088	3.980	1218.7
1.386	1.477	1.681	0.014	1.655	1219.9

As it cannot be expected that the last traces of lanthanium have been removed by crystallization, and that the presence of this metal must diminish the equivalent of the didymium, the preceding numbers can barely indicate a lower limit of this equivalent, and the last results, the highest, must be the nearest to truth; we may thence conclude that the equivalent of didymium is at least equal to 620, perhaps higher; at all events it is not probable that it exceeds much this figure.—*Bibliothèque Univers. de Genève* and *Chem. Gaz.*

ON COLOURING MATTERS.

By Dr. EDWARD SCHUNCK.*

In the report which I had the honour of presenting last year to the British Association on

* From the Report of British Association for 1848.

colouring matters, I gave the results of my investigation of the colouring matters of madder. This investigation I have continued and brought to a conclusion. The subject has, however, proved so extensive, the number of questions arising in regard to this valuable and extensively-used tinctorial substance being very great, that I have been unable to examine any other colouring matters very minutely.

I stated in my last report that, when finely-ground madder roots are treated with hot water, a brown liquid is obtained having a sweetish bitter taste, in which acids produce a dark brown precipitate. This precipitate I stated to consist of six substances, viz., two colouring matters, two fats, pectic acid, and a bitter substance. To these I now add a seventh: it is a dark brown substance which remains behind when the other substances have been removed by means of boiling water and alcohol; it is soluble in caustic alkalis with a dark brown colour, and seems to be the substance to which the colour of the dark brown precipitate is due: I consider it to be oxidized extractive matter. Concerning the method of separating the other six substances contained in the dark brown precipitate, I have nothing to add to what I said in my last report, as I have not been able to discover a shorter or better plan of separating them than that which is there described. In regard to their nature, properties, and composition, which I have examined more minutely, I shall in this report give a number of additional details; before doing so, however, I shall make a few observations on the subject in general. I may state, in the first place, that I have arrived at the conclusion that there is only one colouring matter contained in madder, viz., alizarine; the other substance, which I took for a colouring matter in the first instance, and which I called rubiacane, I now consider to be no colouring matter at all, for reasons which I shall presently state. I have also reason to believe that the two substances which in my first report I called fats are not fats, but resins; they are coloured resins similar to many others known to chemists. Of these two resins I shall call the more easily fusible one, which dissolves in a boiling solution of perchloride or pernitrate of iron, the alpha-resin; the other less easily fusible one, which forms an insoluble compound when treated with perchloride or pernitrate of iron, the beta-resin. The method of preparing them is the same as that which I described in my former report. After the dark brown precipitate produced in a decoction of madder by acids has been successively treated with boiling water and boiling alcohol, there remains behind a dark brown substance; on treating this substance with caustic potash, it dissolves in great part with a dark brown colour; on filtering there remains on the filter a mixture of peroxide of iron and sulphate of lime; on adding a strong acid to the filtered liquid a substance in dark brown flocks is precipitated, which is thrown on a filter, washed, and dried. This substance, when heated on platinum foil, burns without much flame, and leaves a considerable ash. It is easily decomposed by boiling dilute nitric acid, which converts it with an evolution of nitrous acid into a yellow flocculent substance. As it is insoluble in all menstrua except the alkalis, it may be asked, how it can be extracted from madder by means of boiling water, in which it is of itself insoluble, and whether it is not possible that it may be formed during the process of boiling by the action of the air on some substance contained in the extract? I think the latter supposition very probable, and I shall presently describe a substance of almost identical properties, formed by the action of the air on xanthine, the extractive matter of madder. There can, however, be no doubt that the brown colour of the precipitate, which is produced by acids in a decoction of madder, is due to this substance, for the other bodies contained in it are not brown, but yellow or orange-coloured in a precipitate state. This dark brown precipitate, therefore, consists of the following substances:—Alizarine, rubiacine, alpha-resin, beta-resin, rubian, pectic acid, and oxidized extractive matter.

I have examined the liquid filtered from the dark brown precipitate produced by acids more minutely since making my last report. If oxalic acid be used as the precipitant, the excess of acid may afterwards be removed by chalk, without leaving any lime salt in solution. The liquid, which had a light yellow colour, was evaporated on the sandbath. During evaporation it gradually became brown, and left at last a thick dark brown syrup, which never became dry, however long it might be exposed to the heat of the sandbath. On redissolving this syrup in water a considerable quantity of a dark brown powder remained behind. On again evaporating the filtered solution on the sandbath, an additional quantity of this powder was deposited, just as in the case of extractive matter. There can be no doubt that this powder is formed by the action of the air, assisted by heat, on some soluble substance contained in the liquid. On burning a small quantity of the brown syrup in a crucible it swelled up enormously, and gave off a quantity of empyreumatic products, which burned with a flame, leaving at last a considerable quantity of white ash; this ash was partly soluble, partly insoluble, in water. The soluble part had a strong alkaline reaction; it consisted of a trace of lime and magnesia, and a great deal of potash, combined with carbonic, sulphuric, and muriatic acids. The insoluble part consisted of carbonate of lime, carbonate of magnesia, a trace of alumina, phosphate of lime, and phosphate of magnesia. The solution of the brown syrup in water had an acid reaction. It gave no precipitate or peculiar colour with a persalt of iron, and, therefore, contained no tannic acid. The addition of alcohol produced no precipitate or coagulate, and, therefore, there was no gum present. On adding muriatic or sulphuric acid to it, and then boiling, it became dark-coloured, and deposited a green powder. Sugar of lead produced in the solution a dirty brown flocculent precipitate, and basic acetate of lead a still more copious precipitate. A considerable quantity of the brown syrup was dissolved in water, and basic acetate of lead was added until no more precipitate was produced. The precipitate was separated by filtration, and washed with water. The percolating liquid had a yellow colour. The excess of lead was removed from it by sulphuretted hydrogen, and the filtered liquid was evaporated over sulphuric acid, since, if evaporated by the assistance of heat, the substance contained in it was changed by the air, became brown, and deposited a brown powder. After remaining over sulphuric acid for several weeks, there was left a yellow or brownish-yellow syrup like honey, which did not become dry. This substance, though not pure (as it contained salts of lime, magnesia, and potash), I conceive to be identical with Kuhlmann's xanthine and Runge's madder-yellow.

If madder contains sugar, it is evident that, provided the method of operating described above be followed, it must be contained in the same liquid as this xanthine. I have, however, not been able to prove its presence by direct experiment; but I have succeeded in ascertaining indirectly that madder does in reality contain sugar of some kind by means of the following experiment. Half a hundred weight of madder was treated with boiling water for several hours. The liquor, after being reduced by boiling to a convenient compass, was mixed with some yeast, and allowed to ferment. By distillation an alcoholic liquid was obtained, which, after a second distillation, gave 21½ ozs. of alcohol of sp. gr. 0.935, which is equivalent to 9 ozs. of absolute alcohol. It is therefore evident that madder contains sugar of some kind or other.

The precipitate produced by basic acetate of lead in the solution of the brown syrup was decomposed with sulphuretted hydrogen. The filtered liquid was evaporated, and left after evaporation a dark brown syrup, having a strongly acid taste and reaction. The brown colour was no doubt due to xanthine in its oxidized state. After being repeatedly dissolved, and the solution being each time evaporated, a dark brown powder was deposited, just as in the case of the original solution; nevertheless the acid taste always remained. It might be supposed that this taste was due to some vegetable acid; and indeed if any such acid, or the compound of any one with the alkalis or earths, had been extracted from the madder by boiling water, it would most probably have been precipitated by the basic acetate of lead, and it would be in the liquid obtained by the decomposition of the lead precipitate that we should have to look for any such acid. Now, the syrup obtained after decomposing the lead precipitate and evaporating the liquid, though intensely acid, contained no oxalic, tartaric, malic, or citric acid; neither did it show the least sign of crystallization; but the watery solution gave a crystalline precipitate with ammonia and sulphate of magnesia; and after destroying the brown organic matter contained in it by adding nitric acid and boiling, and then evaporating to drive away the excess of nitric acid, it gave a yellow precipitate with nitrate of silver and ammonia. I therefore infer that the acid to which the sour taste of the brown syrup was owing was phosphoric acid.* The sulphuret of lead produced by the decomposition of the lead precipitate was treated with boiling caustic potash. A dark brown solution resulted, which after filtration gave with muriatic acid a dark brown precipitate. This precipitate, after filtration, washing, and drying, cohered into masses, which were brittle and black, but became brown when powdered. It was totally insoluble in boiling water and alcohol. It was decomposed by dilute boiling nitric acid, and changed into a yellow flocculent substance. It was soluble in concentrated sulphuric acid, forming a brown liquid, and was reprecipitated by water. I consider this substance, that formed in a solution of xanthine during evaporation by heat, and the dark brown substance contained in the precipitate produced by acids in a decoction of madder, as the same, and that they are all produced from xanthine by the action of the oxygen of the air.

It still remains for me to say a few words on the substances left behind in the root, after madder has been exhausted with boiling water. It has for some time been well known that if madder, which has already been used for the purpose of dyeing, be treated with a strong acid, such as sulphuric or muriatic, and the acid be then carefully removed by washing with cold water, it is capable of being again used for dyeing in the same way as fresh madder. It is in this manner that the article known in commerce as garanceux is manufactured. This is a convincing proof that it is impossible to extract the whole of the colouring matter by means of boiling water, and that part of it must remain behind in some state in which it is insoluble in water. A quantity of madder was treated with boiling water until the liquid gave absolutely no more precipitate on the addition of muriatic acid. A very long boiling was necessary for this purpose. The colour of the madder was changed by this process from yellowish-brown, as it appears in the fresh state, to a dull red. It was then treated with boiling caustic potash ley. A liquor of a brownish colour was obtained, in which muriatic acid produced a gelatinous precipitate

* On one occasion, after having added nitric acid to the acid syrup and boiled, I obtained on evaporation crystals of an organic acid, very similar to alizaric acid, but not identical with it. It was sparingly soluble in cold water, but very soluble in hot. It was volatile. The watery solution gave with acetate of lead a crystalline precipitate soluble in boiling water, with perchloride of iron a cream-coloured precipitate, with acetate of copper a green crystalline precipitate, and with nitrate of silver and ammonia a white flocculent precipitate. Alizarate of lead is quite insoluble in boiling water, and not in the least crystalline.

of a brown colour. This was separated by filtration, and, after being washed with cold water in order to remove all the muriatic acid, was treated with a large quantity of boiling water, in which it proved to be almost entirely soluble. The solution was light brown. It gave gelatinous precipitates with acids, with lime, and baryta-water, alcohol, and most salts. On evaporation it left a substance in light brown, transparent, brittle scales, which turned out to be pectic acid, much purer, indeed, than that obtained in the first instance from the aqueous decoction. No colouring matter, or any other substance besides pectic acid, seemed to be extracted by the caustic alkali.

Another quantity of madder, which had been completely exhausted by boiling water, was treated with boiling muriatic acid, and the liquid, after the boiling had been kept up for some time, was strained through a cloth and supersaturated with ammonia, which produced a pinkish-white precipitate. This precipitate was thrown on a filter and carefully washed. The liquid contained an abundance of lime and magnesia. A part of the pinkish-white precipitate was dried and heated to redness in a crucible. During ignition a gas came off which was without odour, and burnt with a blue flame, being probably carbonic oxide. After complete ignition it dissolved in muriatic acid with an effervescence of carbonic acid, but without leaving much carbonaceous residue. On adding ammonia to the solution a white precipitate was again produced. The filtered liquid contained a large quantity of lime and a trace of magnesia. The precipitate consisted of alumina, peroxide of iron, phosphate of lime, and a trace of phosphate of magnesia. As it became probable from the preceding reactions that the pinkish-white precipitate contained oxalate of lime, the rest of it was treated with boiling dilute sulphuric acid. The liquid after filtration was evaporated. It gave crystals which were dissolved in alcohol to separate the sulphate of lime. The alcohol on evaporation gave colourless crystals of pure oxalic acid. Hence I infer that the following substances were extracted from the madder by means of muriatic acid:—Lime, magnesia, oxalate of lime, phosphate of lime, alumina, and peroxide of iron. The madder which had been subjected to the action of muriatic acid was now well washed with water, and then treated with boiling caustic potash ley. A dark red solution was obtained, which, after being strained through a cloth, produced, on being supersaturated with an acid, a dark reddish-brown precipitate. This precipitate was thrown on a filter, and well washed with cold water, to remove the excess of acid. I found this precipitate to dye mordanted cloth quite full, and of the same colours as madder itself. There could, therefore, be no doubt about its containing alizarine. Moreover, on treating the precipitate with boiling alcohol, a brownish-yellow liquid was obtained, which left on evaporation a brownish-red residue. A small portion of this residue being heated between two watch-glasses, an abundance of orange-coloured crystals of sublimed alizarine aspeared on the upper glass. By treating the precipitate with boiling water, and filtering boiling hot, the liquid deposited on cooling orange-coloured flocks, which were impure alizarine, for they dyed mordanted cloth, and, after being dried and heated in a tube, they gave a crystalline sublimate. The liquid gave on evaporation pectic acid. That part of the precipitate which was left undissolved by boiling water was treated with a boiling solution of nitrate of iron. The filtered liquid gave, on the addition of muriatic acid, a slight yellow precipitate, which was probably rubiacic acid from the rubiacine of the precipitate. The greater part was insoluble in nitrate of iron. By treating the insoluble residue with boiling muriatic acid, filtering, washing with water, and treating with boiling alcohol, an abundance of beta-resin was procured.

I infer from these experiments that the substances extracted from madder, by caustic potash, after exhaustion with boiling water and treating with acid, previously existed in the root in combination with lime and magnesia; that these substances are not different from those extracted by boiling water, viz., alizarine, rubiacine, resins, and pectic acid; that the compounds of these bodies with lime and magnesia are insoluble in water, and, with the exception of pectate of lime, insoluble in caustic alkalis; and that, therefore, in order to extract them by means of water or an alkali, it is first necessary to remove the lime and magnesia with which they are combined by means of an acid.

I shall now proceed to give some further details concerning the properties and composition of the substances extracted from madder.

Alizarine.—Concerning the properties of alizarine I have nothing to add to what I stated in my last report, except that when crystallized from alcohol it contains several atoms of water of crystallization, which it loses when heated to 212° F. The crystals after being heated to this point have not lost their shape, but have become opaque and of a much redder colour, resembling that of native chromate of lead. On placing them in a tube immersed in a sulphuric acid bath, and heating the bath, no further change takes place until about 420° F., when a sublimate of orange-coloured crystals begins to appear on the cold part of the tube.

On subjecting alizarine to elementary analysis I obtained the following results:—

I. 0.3205 grm. of crystallized alizarine dried in the air gave, on being burnt with chromate of lead, 0.6695 carbonic acid and 0.1210 water.

II. 0.3985 grm. of the same gave 0.8320 carbonic acid and 0.1850 water.

III. 0.3140 grm. gave 0.6565 carbonic acid and 0.1670 water.

These numbers correspond in 100 parts to—

	I.	II.	III.
Carbon	56.97	56.94	57.02
Hydrogen ..	4.19	5.13	5.87
Oxygen	38.84	37.93	37.11
	100.00	100.00	100.00

The great discrepancy in the amounts of hydrogen in the preceding analyses arises from the circumstance that alizarine loses its water of crystallization with such extreme facility. No. I. was mixed with warm chromate of lead in a warm mortar; No. II. was mixed with warm chromate of lead in a cold mortar; and No. III. with cold chromate of lead in a cold mortar. In the case of No. I., therefore, we see that the heat of the chromate of lead and the mortar combined was sufficient to drive away more water than what corresponds to $1\frac{1}{2}$ per cent. of hydrogen, though this heat was not greater than what might be borne by the hand. In order to determine the amount of water of crystallization, crystallized alizarine was heated in a water-bath until it lost no more in weight.

I. 0.4015 grm. treated in this way lost 0.0735 water.

II. 0.3575 grm. lost 0.0655 water.

Alizarine which had been deprived of its water of crystallization by heat gave, on being burnt with chromate of lead, the following results:—

I. 0.2990 grm. gave 0.7575 carbonic acid and 0.1045 water.

II. 0.3005 grm. of a different preparation gave 0.7620 carbonic acid and 0.1095 water.

III. 0.2765 grm. of the same preparation as the preceding gave 0.7010 carbonic acid and 0.1025 water.

In 100 parts it contains, therefore:—

	I.	II.	III.
Carbon	69.09	69.15	69.14
Hydrogen ..	3.88	4.04	4.11
Oxygen	27.03	26.81	26.75
	100.00	100.00	100.00

On analyzing alizarine prepared by sublimation from pure crystals, I obtained the following numbers:—

I. 0.3970 grm. gave 1.0115 carbonic acid and 0.1340 water.

II. 0.4110 grm. gave 1.0510 carbonic acid and 0.1375 water.

In 100 parts:—

	I.	II.
Carbon	69.48	69.73
Hydrogen	3.75	3.71
Oxygen	26.77	26.56
	100.00	100.00

It will be seen from this that sublimed alizarine does not differ materially in composition from alizarine which has been freed from its water of crystallization.

[*To be continued.*]

ON THE INORGANIC CONSTITUENTS OF ORGANIC BODIES.

By H. ROSE,

Professor of Chemistry in the University of Berlin.

[*Continued from page* 70.]

APPENDICES TO PROFESSOR ROSE'S PAPER.

Appendix I. and II.

EXAMINATION OF THE INORGANIC CONSTITUENTS OF PEAS AND PEA-STRAW BY M. WEBER.

300 grms. of peas and 100 grms. of pea-straw were used. After carbonization the mass was treated according to the method previously described.

The aqueous extract, when evaporated to dryness, furnished in the case of the peas, 1.140 grm.; in the case of the pea-straw, 1.417 grm.

These residues gave the following results per cent.:—

	Peas.	Pea-straw.
Chloride of potassium	47.54	7.14
Chloride of sodium	8.16	6.65
Potash.	30.26	57.10
Lime.....	..	0.70
Phosphoric acid.	4.47	..
Sulphuric acid.....	0.79	2.12
Carbonic acid.....	8.33	23.12
Silica	..	1.48
	99.55	98.31

These constituents, when calculated as salts, yield the following composition:—

Peas.		Pea-straw.	
K Cl.	47.54	K Cl	7.14
Na Cl.....	8.16	Na Cl.....	6.65
$3KO+O_2O_5$..	13.32	KO, SO_3.....	2.46
KO, SO_3.....	1.72	KO, CO_2.....	72.62
KO, CO_2.....	26.16	KO, SiO_3.....	4.49
KO, HO.....	3.13	KO, HO	3.88
	100.03	CaO, SO_3	1.69
			98.93

Thus the chlorides exist in the aqueous extract of the carbonized peas in far larger quantity than in that of the pea-straw. Phosphoric acid exists only in the peas; it is entirely absent from the aqueous extract of the carbonized pea-straw; whilst the latter contains a much larger quantity of carbonate of potash than the carbonized peas, so that the evaporated aqueous extract of the carbonized pea-straw would have exactly the same composition as several of the commercial kinds of potash.

The aqueous extract of both the carbonized peas and the pea-straw contained some, although not a large quantity of, free potash, formed by the above-mentioned action of the carbon upon carbonate of potash. As we have already stated, the conversion of the potash into the carbonate by the transmission of carbonic acid through the solution was omitted in all the analyses. Hence it is calculated as potash in the evaporated aqueous extract.

Muriatic Extract.—The carbonized peas after exhaustion with water did not evolve carbonic acid when treated with muriatic acid; the carbonized straw, however, effervesced strongly, and hence contained a large quantity of earthy carbonates. As the amount of carbonic acid could not be determined directly, the lime and magnesia not precipitated from the muriatic solution by ammonia in the form of earthy phosphates are calculated as carbonates.

The composition of the constituents in the two extracts was as follows:—

	Peas.	Pea-straw.
Potash	54.63	
Soda	7.56	
Carbonate of lime	..	60.19
Carbonate of magnesia	..	5.26
Lime	8.22	6.92
Magnesia	6.52	5.69
Peroxide of iron	1.33	1.13
Phosphoric acid	20.79	18.29
Silica	0.95	2.52
	100.00	100.00

The large amount of potash in the acid extract of the carbonized peas is very remarkable. The quantity of phosphoric acid present is about sufficient to form with the lime and magnesia $5CaO, P_2O_5$, and $2MgO, P_2O_5$; the calculated quantity of phosphoric acid would then amount to 21.92 per cent. Were it even admitted that the alkalis had formed with the two earthy phosphates, compounds of *c*-phosphoric acid insoluble in water, the quantity of alkali would be far too great for this purpose; for the potash alone requires more phosphoric acid than was found to form $3KO, P_2O_5$.

The amount of phosphoric acid found in the acid extract of the carbonized pea-straw is exactly sufficient to form *b*-phosphates with the lime and magnesia; the calculated per centage of phosphoric acid would then amount to 18.53. But both the salts undoubtedly exist in the carbonized residue in the form of *c*-phosphates, and the amount of the carbonates of lime and magnesia must be less by so much as is requisite to form *c*-phosphoric acid from the *b*-phosphates.

Remaining Carbonaceous Mass.—The following is the composition per cent. of the ash obtained by incinerating the exhausted carbonaceous mass of the peas and pea-straw:—

	Peas.	Pea-straw.
Potash	24.14	
Lime	5.25	1.87
Magnesia	11.22	14.66
Peroxide of iron	0.85	7.73
Phosphoric acid	58.03	20.80
Silica	0.51	54.94
	100.00	100.00

Considering the large quantity of phosphoric acid in the ash of the peas, we must admit that one portion of the bases is combined with *a*-phosphoric acid, and another with *b*-phosphoric acid. If we calculate the lime and magnesia, as also the small quantity of peroxide of iron, as *b*-phosphates (which certainly ought not to be done in the case of the peroxide of iron), 26 08 per cent. of phosphoric acid are required. If we assume that the remaining 31.95 per cent. of phosphoric acid are combined with the potash to form KO, P_2O_5, we require 21.09 per cent. of potash. The quantity found is 3.05 per cent. more.

For the purpose of showing the important difference which occurs when the incineration of the exhausted carbonized mass is effected by the aid of a solution of platinum, or by my former method, by combustion in oxygen, the result of the examination of the ash of this substance may be brought forward here, as obtained by the latter defective method. In this case it amounted to 1.424 grm. from 300 grms. of peas, whilst by the other method 2.726 grms. were obtained.

It consisted per cent. of:—

Potash	17.83
Lime	8.77
Magnesia	20.85
Peroxide of iron	2.24
Phosphoric acid	46.98
Silica	1.89
	98.56

The amount of the potash and phosphoric acid is diminished by the volatilization of the phosphate of potash; whilst that of the lime, the magnesia, the peroxide of iron, and the silica, have been increased.

The proportion of the phosphoric acid to the bases in the ash of the pea-straw is the same as that in the *b*-phosphates. Yet only lime and magnesia could have been combined with the *b*-phosphoric acid, since the quantity of this acid found is only sufficient for these bases. If the two earths were considered as *b*-phosphates, 21.60 per cent. phosphoric acid would be required. The considerable quantity of peroxide

The following are the inorganic constituents contained in the muriatic extract and the incinerated carbonized residue of peas; they have been added together, because they are sometimes considered as constituting the portions of the ash insoluble in water:—

Potash	32.66
Soda	2.11
Lime	6.08
Magnesia	9.91
Peroxide of iron	0.98
Phosphoric acid	47.62
Silica	0.64
	100.00

We thus see the large amount of alkali contained in those constituents which are insoluble in water, and the presence of which has previously been almost always overlooked.

The inorganic constituents of the muriatic extract and incinerated carbonized mass of pea-straw were:—

Carbonate of lime	54.29
Carbonate of magnesia	4.77
Lime	6.42
Magnesia	6.58
Peroxide of iron	1.78
Phosphoric acid	18.52
Silica	7.64
	100.00

The following is the result of the analysis of the inorganic constituents of peas:—

In the aqueous extract of the carbonized peas	23.61 per cent.
In the muriatic extract	21.48 "
In the ash of the carbonized mass	55.36 "
	100.45

The total amount of inorganic constituents of the peas was 1.64 per cent.

Hence the constituents obtained in the three operations were—

		Oxygen.	
Chloride of potassium	11.02		
Chloride of sodium	1.89		
Potash	32.15	5.44	10.33
Soda	1.62	0.41	
Lime	4.67	1.31	
Magnesia	7.62	2.94	
Peroxide of iron	0.76	0.23	
Phosphoric acid	37.67	21.10	22.84
Sulphuric acid	0.18	0.10	
Carbonic acid	1.94	1.39	
Silica	0.48	0.25	
	100.00		

The pea-straw yielded—

Extracted by water from the carbonized mass	27.00 per cent.
Extracted by muriatic acid	65.87 "
Ash of the residuary carbonized mass	7.13 "
	100.00

The total amount of inorganic constituents of the pea-straw amounted to 5.25 per cent.

The constituents obtained in the three divisions of the analysis yielded:—

		Oxygen.	
Chloride of potassium	1.96		
Chloride of sodium	1.83		
Potash	15.68	2.65	13.18
Lime	27.14	7.62	
Magnesia	6.50	2.51	
Peroxide of iron	1.30	0.40	
Phosphoric acid	13.52	7.57	26.37
Sulphuric acid	0.57	0.34	
Carbonic acid	25.52	18.46	
Silica	5.98		
	100.00		

The proportion of the oxygen of the bases to that of the acids in both the peas and the pea-straw is therefore as 1 : 2. The oxygen of the silica in the pea-straw is not added to that of the other acids, because it is not combined with bases in the straw.

The manner in which the inorganic constituents of organic substances are usually determined consists in the direct incineration of the organic substance, and in arranging the constituents found in the analysis, by uniting the strongest bases with the strongest acids. The carbonic acid in many cases was not determined directly; and the portion of the bases remaining, after calculating the salts formed by them with the acids found, was assumed as carbonates. The above results show to what very erroneous ideas this method of arrangement may lead. On calculating according to the above principle the salts from the numbers quoted last, we should obtain totally different arrangements, or at least totally different per-centage results from those obtained by the separate exhaustions of the carbonized substance. Thus all the alkali, for instance, in the ash of the peas remaining after calculating the amounts of chloride and alkaline sulphate would be regarded as alkaline phosphate. The phosphoric acid then remaining would be combined with other bases, and what remained of the latter would be regarded as combined with carbonic acid. But we have now seen that part of the potash exists in the aqueous solution of the carbonized mass in the state of carbonate, and that in the teleoxidic portion of the carbonized mass the earths extracted by the muriatic acid could only have been combined with phosphoric acid, because no carbonic acid is evolved when an acid is added.

This principle is seen to be still more erroneous in the determination of the inorganic constituents of the pea-straw. No phosphoric acid exists in the aqueous extract of the carbonized mass, but almost all the potash is combined with carbonic acid, whilst the earths in the teleoxidic portion of the carbonized mass are mostly conbined with carbonic acid, and partly with phosphoric acid.

The fact that organic substances, the ash of which consists principally of earths, may be very easily incinerated, whilst those which contain a large amount of alkalis are very difficultly so, forms an important objection to the complete incineration of the organic substance for the determination of the amount of ash contained in it. For, by the prolonged heat required in the latter case, the greater portion, and frequently the whole, of the alkaline chlorides, especially the chloride of potassium, is volatilized; or by the action of *b*-phosphates with the aid of water, or by the hydrogen evolved and the oxygen of the air, muriatic acid is liberated, and they are thus converted into *c*-phosphates. Carbonic acid is driven off in the same manner. For this reason, in the incineration of those organic substances which abound in alkalis, Wackenroder has proposed to mix them with a weighed quantity of an earth, to prevent their fusion and to promote the ready combustion of the carbon.

[*To be continued.*]

ON THE CHEMICAL COMPOSITION OF THE FLUID IN THE ASCIDIA OF NEPENTHES.

By Dr. A. VOELCKER, of Frankfort.*

The watery secretions of certain plants belonging to the genera Nepenthes, Cephalotus, and Sarracenia, have long attracted the attention of botanists; but, whilst the secreting organs of these plants have been minutely described, the chemical nature of the fluid itself has been but very imperfectly examined. That these liquids have not met with the attention to which their importance entitles them may be accounted for by the circumstance that few chemists have an

* From the "Annals and Magazine of Natural History," Second Series, vol. iv., p. 128.

opportunity of obtaining the unaltered fluids, and that even those who are fortunate enough to procure them seldom can command a sufficient quantity to enable them to investigate their nature. With the exception of Dr. Turner's analysis of the fluid in the ascidia of Nepenthes, I know of no other analysis of this fluid or of similar secretions. The botanists who have given attention to the subject of the watery secretions of the leaves of plants have found these secretions to consist in most cases of nothing but pure water, and have only occasionally discovered in them some vegetable matter. Treviranus, for instance, observed a tasteless water in the corolla of Maranta gibba, which he, however, did not further examine; the same gentleman examined the watery secretion of Amomum zerumbet, and caused Dr. Göppert to subject it to chemical analysis, from which it resulted that the fluid between the scales of the spikes consisted of almost pure water, containing a small quantity of vegetable fibre and mucus.

The most remarkable instance of a watery secretion from the leaves of plants is recorded in the "Annals of Natural History" for 1848, in a paper by Mr. Williamson, who observed that the leaves of Caladium destillatorium had the peculiar power of exhaling watery fluid from a point near the apex on the upper side. Each full-grown healthy leaf, according to Mr. Williamson's observation, produced about half a pint of water during the night, which, on being analyzed, was found to contain a very minute portion of vegetable matter.

It appeared to me highly improbable that these fluid secretions should consist of pure water with merely a trace of vegetable matter, and no inorganic substances whatsoever. If they are to be regarded as true secretions, we naturally should expect them to contain some of the salts which we find in all juices of plants. I was, therefore, anxious to examine this point, and I am glad that I have an opportunity of bringing the results of my analysis of the fluid in the ascidia of Nepenthes before the notice of the Botanical Society. It is through the kindness of Prof. Balfour, Mr. Evans, of the Experimental Gardens, Messrs. Jas. Dickson and Sons, and Sir W. Hooker, that I have obtained the materials for the following analysis, and I consider it my duty to express here publicly my deep sense of gratitude for the kindness and liberality with which the above-named gentlemen have assisted me in carrying on this inquiry. I have also to express my obligations to Dr. George Wilson for kindly allowing me the use of his laboratory.

Linnæus regarded the ascidia of Nepenthes as a natural reservoir for rain, and thought that the water found in them was introduced from without, and was not secreted by the plant itself. His opinion, however, has been contradicted already by many botanists, especially Treviranus, who observed that the water in the pitchers of Nepenthes destillatoria is always clear, and that there exists a distinct secreting apparatus. Treviranus says, in an article which appeared in the "Edinb. New Philosoph. Journal" for October, 1832, April, 1833:—"The parietes of the leaf of Nepenthes destillatoria are traversed by a multitude of proportionally large anastomosing veins, which contain many true spiral vessels. The upper half of its inner surface is covered with a blue rind, as parts often are which require to be protected from the action of water; the under half is, on the contrary, shining and full of gland-like eminences directed downwards, and having a hole almost visible to the naked eye, which is uncovered by the cuticle which the remainder possesses." The watery secretion reaches generally to the level of these glands in the middle of the ascidium, and he thinks that they are true secreting organs. This peculiar structure alone gives a strong reason for thinking that the water in the ascidia of Nepenthes is supplied by the plant itself, and the circumstance that water is found in pitchers which have never been opened is another argument against the supposition that it comes from without. The subjoined analysis of the fluid moreover leaves no doubt that it is a true secretion.

Before I enter into the particulars of my experiments I will mention that I could not detect any oxalic acid in the fluid of Nepenthes. It is stated in Lindley's "Vegetable Kingdom" that Dr. Turner found this acid in combination with potash, and that he also detected a trace of organic matter, which caused the watery fluid when boiling to emit an odour of boiled apples. Though I have examined the water of many pitchers from four different localities, and paid particular attention to the detection of oxalic acid, I have failed in finding a trace of it, and I am, therefore, inclined to believe that Dr. Turner, on account of the minute quantity of solid matter which he must have got on evaporation of the water, was unable to subject the minute crystals which he took for superoxalate of potash to a further examination, which would have shown him that the crystals were not superoxalate of potash, but chloride of potassium. The proportion of chloride of potassium which I found in the fluid is considerable; it is deposited from the liquid after evaporation in the form of minute but very regular cubes. The odour of boiled apples which Dr. Turner observed I found very distinct when the water was heated to the boiling-point. Besides chloride of potassium I found malic and a little citric acid, in combination usually with soda, lime, and magnesia, and a small quantity of another organic matter which gave a yellow tint to the water during its evaporation. The quantity of the latter was too minute to enable me to ascertain its chemical nature.

I will now proceed to describe the experiments with the different fluids in the ascidia of Nepenthes:—

1. Fluid from an unopened pitcher-plant grown in the Botanical Garden, Edinburgh.

The water which I got on the 12th of June, 1849, was perfectly colourless and clear; it had an agreeable, not very pronounced smell and a refreshing taste. Though its taste was not sour, litmus paper showed the presence of an acid or an acid salt by the red colour it assumed when dipped in the water. When heated it remained clear, and only assumed a slightly yellow colour when the liquid became very concentrated. The residue which remained on evaporation was cream-coloured, very hygroscopic, and dissolved entirely in a small quantity of distilled water. Litmus paper plunged in this solution was turned red immediately; the acid which is present in the water, therefore, was not volatilized during the evaporation.

The quantity of the water from one pitcher amounted to

17.41 grains,

which gave, on evaporation,

0.16 of dry residue, dried at 212° F.

100 parts of the fluid consequently contained

0.92 per cent. of solid matter.

2. Water from unopened pitcher-plants grown in the Botanical Garden, Edinburgh, June 13, 1849.

The physical characters were the same as those of the preceding liquid. Litmus paper likewise was turned red when dipped in the water.

The behaviour of the water towards chemical tests was as follows:—

Ammonia produced no change.

Carbonate of ammonia produced no change.

Lime-water produced no change.

Chloride of calcium and ammonia produced no change.

Nitrate of barytes produced no change.

Nitrate of silver gave a white voluminous precipitate, insoluble in nitric acid, but soluble in ammonia.

Acetate of lead produced a white precipitate soluble for the greater part in boiling water.

Basic acetate of lead gave a white voluminous precipitate in the clear liquid filtered from the precipitate which was caused by neutral acetate of lead.

Oxalate of ammonia produced a small white precipitate of oxalate of lime.

Phosphate of soda and ammonia, added to the concentrated liquid filtered from the oxalate of lime, gave a crystalline white precipitate of phosphate of magnesia and ammonia.

Chloride of platinum, added to the water after having been evaporated to a small bulk, produced a crystalline yellow precipitate.

The residue left on evaporation of the water coloured the alcohol-flame yellow.

These reactions indicate the presence of chlorine, potash, soda, magnesia, lime, and organic acids, and prove the absence of other bases and of sulphuric acid, tartaric acid, racemic acid, oxalic and phosphoric acid.

3. Fluid from unopened pitcher-plants grown in the Experimental Gardens, Edinburgh, June 13, 1849.

The water was perfectly clear and colourless, had an acid reaction on litmus paper, and exhibited the same physical and chemical characters as the fluid from the pitcher-plants of the Botanical Garden.

63.21 grains of water left on evaporation a residue which, dried at 212° F., amounted to

0.58 grain.

100 parts of the fluid, therefore, contained

0.91 per cent. of dry residue.

Exposed to a red heat, the residue (0.58 gr.) turned black, and gave off pungent fumes, and left a white ash after all the charcoal was completely burnt away, the weight of which was 0.42 of a grain.

The loss by burning, therefore, was 25.86 per cent.

The residue left on evaporation of this fluid was slightly coloured, and gave an almost colourless solution with water. A portion of this solution was kept in a closed bottle. After the lapse of a fortnight the water in the bottle became turbid and deposited some light white flakes. The acid reaction, which was very distinct before, had now disappeared entirely.

4. Fluid from open pitcher-plants grown in the Experimental Gardens, June 14, 1849.

The fluid in the open pitchers was coloured yellow, but otherwise perfectly clear. The reactions with chemical tests were the same as the preceding.

97.74 grains of water left on evaporation 0.85 of a grain of dry residue.

100 parts, therefore, contained 0.87 per cent. of solid matter.

This residue was coloured yellow, but redissolved entirely in a little water.

5. Fluid from unopened pitcher-plants grown in Messrs. Dickson's nursery, June 17, 1849.

Fluid perfectly clear and colourless; reactions the same as above.

319.43 grains left a residue which, dried at 212° F., was found to weigh 1.88 grain; or,

100 parts of the liquid contained 0.58 per cent.

6. Liquid from unopened pitcher-plants grown in Messrs. Dickson's nursery, June 21, 1849.

Physical and chemical characters of the liquid the same as above.

193.82 grains of water left on evaporation 1.22 grain of dry residue, or 0.62 per cent.

When burnt the 1.22 grain lost in weight 0.44 of a grain, or 100 parts of the residue lost 36.06 per cent.

The solid matter of this liquid was very hygroscopic, and coloured more yellow than that of the Botanical and Experimental Gardens. I found that the total weight of the solid matter in this fluid was not so large as in that of the Experimental Gardens, but that the proportion of organic matter in the residue was larger than that in the residue of the fluid procured from the Experimental Gardens.

7. Water from opened pitcher-plants grown in Messrs. Dickson's nursery, June 24, 1849.

This fluid was yellow-coloured and not quite clear. Litmus paper was turned red when moistened with the water. The reactions were the same as above, with the exception that nitrate of barytes produced a slight turbidity, indicating the presence of sulphuric acid. As I

found no sulphuric acid in the liquid from the unopened pitchers of the same plants, nor in any of the liquids I examined, I think the sulphuric acid which I found must have resulted from the water with which the plants had been watered which had found its way into the open pitchers*. In order to see if the liquid contained any volatile acid, I subjected about half an ounce of it to distillation. The distillation was continued till the residue in the glass retort was evaporated to dryness, and the generated steam carefully condensed in a glass receiver. The distilled portion was perfectly pure water, and experienced no change by any reagent.

It results from this experiment that the liquid in the ascidia of Nepenthes does not contain any volatile acids, such as acetic acid or formic acid.

8. Fluid from unopened pitcher-plants grown in the Royal Gardens, Kew.

Having been unable to detect any oxalic acid in the above-mentioned fluids, I was anxious to ascertain whether or not the fluid of plants grown in other localities contained oxalic acid. I therefore applied to Sir W. Hooker, who, with great liberality, directed some liquid of unopened pitcher-plants grown in the Kew Royal Botanical Gardens to be sent to me. The physical and chemical characters of this fluid were precisely the same as those of the previously-examined liquids. The proportion of solid matter it held in solution, however, was much smaller.

299.87 grains of the liquid left on evaporation only
0.82 of a grain of dry residue.
100 parts of the liquid, therefore, contained
0.27 per cent. of solid matter.
On burning, the 0.82 of a grain lost 0.27 of a grain, or
100 parts lost 32.92 per cent.

All the liquids from the different localities above mentioned, which were left over, I mixed together, and evaporated the mixture to dryness. One half of the dry residue I exposed to a red heat, and used the remaining white ash for the determination of the inorganic salts of which it was composed.

The other half I dissolved in water, and precipitated with basic acetate of lead, in order to obtain the organic acids in combination with lead. This precipitate I collected on a filter, and washed with cold distilled water. It was then removed from the filter and suspended in water, through which a current of sulphuretted hydrogen was passed. By this means I separated the lead as sulphuret, and obtained the organic acids free dissolved in water. This solution was colourless and very acid; evaporated to a small bulk in a water-bath, it assumed a yellow colour, and dried at last to a yellow crystalline mass, which deliquesced in the air and dissolved readily in water and alcohol, leaving behind a trace of a brown organic matter.

Lime-water, added in excess to a portion of the acid solution, produced no precipitate in the cold, but on boiling a small white precipitate fell down, which redissolved entirely in sal ammoniac.

Chloride of calcium and ammonium left the liquid unchanged in the cold, but on boiling a precipitate was formed, which was soluble in sal ammoniac.

Acetate of lead gave a white precipitate, insoluble in ammonia, soluble in acetic acid.

Basic acetate of lead, added to the liquid filtered from the precipitate caused by neutral acetate of lead, produced another abundant white precipitate. From these reactions it appears that the precipitate with lime-water was caused by citric acid and not by tartaric or racemic acid, the reactions of which acids are similar to those of citric acid, for tartrate of lime is not soluble in sal ammoniac, whilst tartrate of lead redissolves readily in ammonia. Tartaric acid, moreover, is sufficiently characterized by the sparing solubility of its acid potash salt, and, as the acid liquid did not give rise to the formation of such a salt with potash, we have another indirect proof of the presence of citric acid. A little tartaric acid, added to the liquid in which tartaric acid was sought in vain, after a few minutes produced the sparingly-soluble potash salt.

Racemic acid is thrown down both by lime-water and by a solution of gypsum; the acid liquid of Nepenthes remained unchanged by either reagent,—hence it cannot have contained any racemic acid.

The precipitate caused by chloride of calcium and ammonia and boiling was filtered hot, and alcohol and ammonia added to the clear liquid. The addition of alcohol produced a voluminous white precipitate, a reaction which indicates the presence of malic acid. The quantity of this precipitate was much larger than that of the lime precipitate which citric acid gave. The formation of a precipitate, upon addition of alcohol to the liquid from which the first had been separated by filtration, is characteristic of the presence of malic acid, for no other lime salts were present; for instance, no sulphate of lime was present which could have produced a precipitate. But I thought it nevertheless necessary to examine the precipitate caused by the addition of alcohol further. When burnt it turned black, gave off pungent vapours, and was converted into carbonate of lime. The solution of chloride of calcium and ammonia used for the experiment remained clear after the addition of alcohol; the acid liquid likewise remained clear when alcohol was added; both put together immediately produced a white voluminous precipitate.

Basic acetate of lead, as already mentioned, throws down from the solution a white precipitate. I could not observe that this precipitate melted below the boiling point of water, as pure malate of lead does, but it must be remembered that this reaction is distinctly marked only when the malate of lead is pure; admixtures of other salts of lead prevent it altogether; and, as I have shown the presence of citric acid and another organic substance which is thrown down by basic acetate of lead, there can be no doubt that this was the reason why the precipitate did not dissolve in boiling water.

Though I have not been able to obtain a sufficient quantity of the acids of Nepenthes for an elementary analysis, I think the above reactions prove the presence of malic and citric acid. Oxalic acid, which is readily detected, as the weakest solution of an oxalate is thrown down by lime-water, I failed to discover; on the contrary, I have shown that the water contained lime, which excludes the coexistence of oxalic acid in a clear liquid. I have found that the smallest quantity of oxalic acid immediately caused the water of Nepenthes to become turbid.

The second half of the residue left on evaporation of the mixed fluids I exposed to a red heat in a platinum capsule. It turned black, gave off pungent fumes, and left a white salt after all the charcoal was burnt off.

On analysis this residue was found to consist of:—

Chloride of potassium	76.31
Carbonate of soda	16.44
Lime	3.94
Magnesia	3.94
	100.63

The unburnt residue left on evaporation of the fluid in the ascidia of Nepenthes, therefore, consists, if we take the average of the loss of the three determinations at 31.61 per cent., and reject the carbonic acid of the ash, of:—

Organic matter, chiefly Malic acid and a little citric acid	38.61
Chloride of potassium	50.42
Soda	6.36
Lime	2.59
Magnesia	2.59
	100.57

It is remarkable that none of the fluids which I examined contained any sulphuric acid, which acid has been found in all juices of plants, and which I do not doubt also exists in the sap of Nepenthes. An ash analysis of this interesting plant would show the proportion of sulphuric acid at once; and as we are not in possession of an analysis of the ash of Nepenthes, which in other respects might be of interest, I take the liberty of asking those gentlemen who are in the possession of Nepenthes' plants to preserve the clippings of branches, &c., which I shall be glad to receive as materials for an ash analysis.

* The water in this instance was procured chiefly from the Water of Leith.

THE PROBABLE CAUSES IN OPERATION TO PRODUCE PESTILENTIAL CHOLERA.

By ROBERT HUNT, Esq.

Although it would be idle to assert that anything approaching to even a remote acquaintance with the causes which are in operation to produce the terrible disease that is moving across the earth, spreading mourning in its path, has been arrived at, it does appear that the scientific investigations which have within a few years been made upon the chemical and physical states of the atmosphere are such as really indicate the direction in which we may look with some hope of finally arriving at a solution of this important problem. In the conviction that it is only by a widely-extended system of close observations that we can come at the truth, and that our hope of dealing successfully with the disease depends, of course, on our knowledge of the causes producing it, I seek a small portion of space in the pages of the *Athenæum* to submit my views, and the facts on which they are founded, to the consideration of scientific observers and medical men.

If we study the progress of the disease, it becomes apparent that, taking its rise in the East, it has proceeded with some considerable degree of regularity towards the West. There are certain irregular passages—jumps both in time and space—which do not admit of explanation at present; but the course has been sufficiently marked to cause the cholera in its Asiatic form to be regarded as mainly dependent upon some atmospheric conditions. In all cities which have been visited by the disease, although isolated cases have presented themselves in the most salubrious parts, yet it has ever been most fatal in those localities where the atmosphere has become charged with organic matter arising from the accumulation and decomposition of animal and vegetable substances.

Our experience proves to us that there are no more insidious or more rapidly fatal poisons than those which organic chemistry has discovered, and of many of the most virulent the exact composition is yet unknown. Of the numerous chemical changes which take place during the passage of decomposing organic matter, under constantly varying conditions of light, heat, atmospheric pressure, &c., we know little. May we not, therefore, infer that malignant cholera is produced by a subtle organic poison formed under some peculiar atmospheric laws? The probability of this being admitted, we have to examine the prevailing conditions observed in any physical phenomena during the reign of the epidemic.

We have heard that at St. Petersburg magnets lost their power, and that in Paris electrical machines would not give out sparks, during the ascendancy of cholera in those cities. Statements of this nature have but little scientific value. However, that they have resulted from some remarkable phenomena of the kind described is probable; since M. Quételet has proved by careful observation that the electrical intensity of the atmosphere has been during the whole year about one half of that observed in former years—that it has been regularly diminishing since January up to a certain period—and that it has appeared for some time stationary. M. Louyet has observed the same anomalous condition by means of his electrical machine in the interior of his house.—("Bulletin de l'Académie Royale des Sciences de Belgique," No. 7, tome xvi.) These results

obtained by competent observers demand our serious attention. We must not, however, satisfy ourselves by referring the disease at once to electrical agency, but endeavour to discover in what manner, or through what chain of effects, the malignant action is set up in the animal economy.

To Professor Schönbein is due the merit of having discovered the existence, in ever-variable quantities, in the atmosphere of a peculiar agent of a most remarkable character, to which he gave the name of ozone; which appears to be, although its composition has not been accurately determined, a peculiar volatile compound of oxygen and hydrogen. A similar compound, perhaps the same in a liquid state, the peroxide of hydrogen or oxygenated water, has engaged the attention of Thénard, Pélouze, Berzelius, and several other eminent chemists. By these investigators it has been proved that this substance possesses more remarkable oxidizing powers than any other compound yet discovered. Its volatile state alone must, however, engage attention. Ozone is constantly produced in the atmosphere under every circumstance which determines either electrical or chemical changes; and its amount appears to vary in an exact ratio with the electrical intensity. We may produce it in a room by exciting an ordinary electrical machine—when it is detected by its very peculiar smell; we obtain it during the decomposition of water by the voltaic battery in combination with the liberated oxygen; and Schönbein has proved that ozone is formed in every process of combustion.

The use of this agent in the atmosphere will, I think, be obvious after a very brief consideration of the conditions which prevail during the mutations of organized bodies. All living animals and vegetables are constantly throwing off from their bodies organic matter in a condition the most fitted for recombination with the chemical elements of the air. The gaseous exhalations from all dead matter are also constantly combined with organic particles in a state of extreme division.—(On this subject Dr. Smith's paper on "The Air and Water of Towns," British Association Report for 1848, may be consulted with advantage). Thus, the atmosphere is constantly receiving exhalations from the earth and its inhabitants, which, without a provision for their removal, would speedily become far more injurious to all forms of life than carbonic acid, though to that alone we have been in the habit of too commonly attributing atmospheric deterioration. Referring to those pestilential exhalations which were regarded as the cause of the gaol fever of his time—and to which we may trace plague, typhus fever, and cholera—Bacon, in his "Salva Sylvarum," says truly, "Out of question such smells consist of man's flesh and sweat putrified;" and the destructive nature of such a poison is too frequently proved to us by the apparently trifling accidents of the dissecting-room terminating rapidly in the most fatal results.

Ozone combines with and changes in the most rapid manner all animal matters, except albumen in its fresh state. I am, therefore, disposed to consider it as the great natural agent employed to convert all those deleterious exhalations which the air receives into innocuous matter. An atmosphere artificially charged with ozone immediately deprives the most putrid solid or fluid bodies of all disagreeable smell; and sulphuretted hydrogen is instantly decomposed by it. In fact, its action upon organic matter is far more energetic than that of chlorine; and, indeed, the bleaching and disinfecting property attributed to chlorine appears to be due to the formation of the peroxide of hydrogen by that agent from the water present.

It has been proved that the electrical intensity of the atmosphere has during the year been diminished in a remarkable manner. As this is the great cause, ever active in producing ozone, we might *à priori* infer a relatively diminished quantity of this chemical agent; and experiment has proved that during the last three months an appreciable quantity of ozone could not be detected by the ordinary methods in the air of London. It may be satisfactory to state, that its presence is rendered evident by its action upon a mixture of iodide of potassium and white starch: iodine is liberated by the action of ozone, and the formation of coloured iodide of starch indicates its presence.

Certain it is, that we have for several months had to endure an atmosphere of low electrical intensity, deficient in ozone, an agent which would remove, or alter, pestilential miasma. Vegetation has exhibited, and is now exhibiting, peculiar abnormal conditions dependent upon solar influences of which we are absolutely ignorant; consequently, the atmosphere has been receiving an excess of organic poison from the thousand and one sources which the congregation of masses of men in towns gives rise to, and has remained unchanged to do its work of destruction upon humanity.

In the history of the progress of this pestilence two remarkable instances present themselves to our notice. Birmingham and Berlin have remained free from the scourge, while all cities and towns around them have been visited by it. Are the metallic manufactures of these towns active in producing this disinfecting agent, ozone?

The question naturally arises—have we any power by which we can restore to the air this principle which it requires? All human means are necessarily weak, and the inflictions of Providence must be endured with fortitude. At the same time, the powers of reason which are given to man for his guidance should be exerted to ameliorate the evil that we cannot control. Our first study is to remove every source of decomposition as rapidly as possible from the precincts of our dwellings: our next to watch ourselves, and, by preserving an active condition of mind and body, fortify the system against the malign influences which surround us. Subsidiary to these means,—since we know that ozone is formed in the process of combustion, and that large fires have proved again and again effectual in stopping the progress of the plague, &c.,—bonfires, heavy discharges of artillery, and the like agents might be tried in the worst districts. Lastly,—with all deference to the opinions of the medical world, with which I have ceased for many years to be connected,—I would suggest the propriety of trying oxygenated water as a remedial agent in Asiatic cholera.

Each time that the cholera has disappeared from amongst us it has been rapidly followed by influenza. At the meeting of the British Association at Swansea, Dr. Moffatt communicated the remarkable fact, that the prevalence of influenza and the spread of catarrhal affections were invariably connected with an excess of ozone in the atmosphere, and a great number of altered test-papers were brought forward in proof of his statement.

The subject demands attentive inquiry, and, since it is a question which can be answered only by simultaneous observations over a wide area, I would venture to suggest the propriety of its forming a topic of investigation for a committee of the British Association.—*Athenæum.*

REMARKS ON THE PRECEDING ARTICLE.

By ANTI-ZYMOSIS.

[From the *Morning Chronicle.*]

"If the rules of the inductive philosophy are to be applied to medicine," says an eminent physician and philosopher, in treating of the application of the principles of philosophical investigation to medical science, "the immediate effect of them must be to banish all such speculations as are contrary to the first rules of sound investigation. They are entirely fictitious principles framed to correspond with the phenomena, instead of being deduced from them. The only mode of detecting their character is to bring them to the test of inquiry—are they facts, and are the facts universal? The rules to be observed in deducing general principles," the author adds, "appear, therefore, to be the following:—1. That the principle assumed be a fact. 2. That it be true, without a single exception, of all the individual cases—or, in other words, that the fact be universal." These constitute, as it were, the canons of medical science, and at the present moment there is a greater necessity than ever that our reasons should be guided by them.

Within the last week a new explanation has been put forward as to "the probable causes at work to produce pestilential cholera." Let me first give a brief abstract of the facts and opinions advanced, and then proceed to point out what appears to me to be the strength and weakness of the conclusions. "The probability that malignant cholera is produced by a subtle organic poison formed under some peculiar atmospheric laws being admitted," says the author, "we have to examine the prevailing conditions observed in any physical phenomena during the reign of the epidemic." He then informs us M. Quételet, the Belgic philosopher, has proved that the electrical intensity of the atmosphere during the whole year has been only one half that of former years; that it has been regularly diminishing since January up to a certain period; and that it has appeared for some time stationary. M. Louyet, he tells us, has observed the same phenomenon.

Let us now see what would be the necessary consequence of such an atmospheric condition. A few years back Professor Schönbein (the inventor of gun-cotton) discovered that the peculiar smell which invariably attends the working of an ordinary electrifying machine is due to the formation of a new and most remarkable substance, which he termed "Ozone." This substance appears to be a gaseous form of "peroxide of hydrogen" (*i.e.*, water with an extra dose of oxygen), which is possessed of more remarkably oxidizing powers than any other compound yet discovered. Ozone is constantly produced in the atmosphere under every circumstance that determines either electrical or chemical changes, and its amount appears to vary in an exact ratio with the electrical intensity. Its chemical affinities are such that it combines and changes in the most rapid manner all animal matters except albumen in its fresh state. An atmosphere artificially charged with ozone immediately deprives the most putrid solid or fluid bodies of all disagreeable smell, and sulphuretted hydrogen is instantly decomposed by it. Hence, adopting the zymotic theory of epidemics, the writer says he is disposed to consider it "as the great natural agent" employed to convert all those deleterious zymotic exhalations which the air receives into innocuous matter. He then reasons thus:—It has been proved that the electrical intensity of the atmosphere has during the year been diminished in a most remarkable manner. As this is the great cause of ozone in the atmosphere, we might have inferred *à priori*, he says, that there would be a proportionately diminished quantity of this energetic chemical agent; and "experiment," he informs us, "has proved that during the last three months an appreciable quantity of ozone could not be detected by the ordinary methods in the air of London." We have had, therefore, to endure for several months an atmosphere of low electrical intensity, and therefore deficient in ozone—and, therefore again, deprived of an agent which would remove or decompose pestilential miasma. Consequently the atmosphere has been receiving an excess of organic poison from its thousand and one sources of vegetable and animal decomposition, and, owing to the deficiency of ozone in the atmosphere, that poison has not only remained unchanged, but been continually accumulating, to do its work of destruction upon humanity.

In corroboration of these views, the writer concludes by telling us that "each time the cholera has disappeared from among us it has been rapidly followed by influenza, and that, at the

meeting of the British Association, Dr. Moffat communicated the remarkable fact that the prevalence of influenza and the spread of catarrhal affections were invariably connected with an excess of ozone in the atmosphere—a great number of altered test papers being brought forward in proof of the statement."

Let us now apply the canon laid down at the commencement of this letter to the explanation above given, and ascertain how many of the principles assumed as causes of pestilential cholera are facts.

1. It is a fact that the electrical intensity of the atmosphere has during the present year been diminished in a most remarkable manner. Of this the careful observations and philosophic character of M. Quételet are sufficient to assure us.

2. It is a fact that ozone is a product of electrical action, and, consequently, that the amount of it in the atmosphere would vary in an exact ratio with the electrical intensity.

3. It is a fact that ozone combines with and changes in a most rapid manner all animal matters—except albumen in its fresh state—and that it immediately deprives the most putrid and solid bodies of all disagreeable smell.

4. It is a fact, proved by experiment, that during the last three months not even the minutest quantity of ozone could be detected in the air of London.

5. It is a fact—proved also by experiments of the same kind—that during the prevalence of influenza and the spread of catarrhal affections there is invariably an excess of ozone in the atmosphere.

Here, then, we have five unquestionable and most important facts connected with the prevalence of the pestilential cholera among us. Of the other agents assumed as causes of the same disease, they come under the head of "fictitious principles," framed to correspond with the phenomena instead of being deduced from them. Of such a character, indeed, is the very cause to which the cholera is directly attributed by the author of the preceding explanation, the disease being considered by him to be the necessary consequence of an excess of organic poison in the atmosphere, and the deficiency of ozone being cited merely as the cause of this excess. This appears to us to constitute the great mistake of his reasoning, and affords another striking instance of the intellectual effort required to shake off all preconceived ideas from the mind when endeavouring to trace some known phenomenon back to its unknown cause.

The writer, unable to divest his mind entirely of the phantasm of the Board of Health, persists in attributing the disease directly to a "subtle organic poison formed under some peculiar atmospheric laws." Of the nature and properties, or, indeed, existence, of this particular poison he offers us no more evidence than the Board of Health itself. Indeed, like the authors of the zymotic theory, he confesses that, of the numerous chemical changes which take place during the passage of decomposing organic matter under constantly-varying conditions of light, heat, atmospheric pressure, &c., we know little; and yet, with that peculiar obliquity of mental vision for which all theorists are celebrated, he makes our very ignorance as to the nature of this zymotic poison the reason why we should conclude that it is the cause of the epidemic. For, immediately after he has acknowledged that we know little about it, he says, "may we not, therefore, infer that malignant cholera is produced by some subtle organic poison?" Then, in the true spirit of logical mendicancy, begging the entire question, he adds that, "the probability of this being admitted, we have to examine the prevailing conditions observed in any physical phenomena during the reign of the epidemic."

As, however, I, like you, Mr. Editor, do not feel disposed to take this same zymotic poison for granted, why, I must confess I am sceptical enough to require some experimental proof of its reality before I give any credence to its existence. In accordance, then, with the rule laid down at the beginning of this letter, I demand to know—first, is the principle assumed a fact? I ask what evidence have the zymotic theorists that there is any such substance in nature? Have they analyzed the atmosphere in those localities where the cholera has been raging, and found that, after separating the known atmospheric constituents from one another, there has been invariably present in it, over and above these, some new zymotic substance or gas, before unknown to chemists, which has the property of acting as a violent poison on the animal economy, and of inducing, when absorbed into the system, some peculiar form of epidemic disease—either typhus or yellow fever, scarlatina, influenza, plague, or cholera (for these are all said to have the same zymotic cause), according as it is more or less diluted with atmospheric air? Have they, moreover, analyzed the blood of patients labouring under any one of the above forms of disease, and—since, according to the theory, this poison enters through the lungs into the circulation, and there communicates a state of decomposition to the fluids of the body, by the same catalytic process as yeast produces fermentation—have they discovered what Dr. O'Shaughnessy failed to perceive—the presence of this same zymotic substance, or gas, in the blood itself? If there were any such substance in nature, chemistry could hardly fail to detect it. Its presence in the atmosphere admits of being proved by experiment as much as that of ozone itself. But nothing of the kind has been done. The existence of this poison is as purely a matter of supposition now as it was before the cholera broke out amongst us. Still, even admitting the principle assumed as the cause of cholera to be a fact, it cannot be said to be an universal one, and true, without a single exception, of all the individual cases; for it has been shown by instances cited from the Indian reports, and by the example of Belleville, at Paris, that so far from the noxious gases given off by decomposing animal matter, under a peculiar condition of the atmosphere, being the invariable and necessary antecedent of cholera, several localities in which the atmosphere was impregnated with the effluvium of animal substances in a zymotic state have entirely escaped the affliction.

Hence it appears that, according to the principia of philosophical investigation, we are bound to reject this same zymotic poison from our reasonings altogether, until such time as its existence has been proved experimentally, and it is changed from a theoretic figment into a scientific fact. Let us then, discarding the "subtle organic poison" as one of the many fictitious principles framed to correspond with the phenomena, instead of being deduced from them, and so, separating the fiction from the truth, see whether the five known phenomena above stated will enable us to discover the direction in which we may really look with some hope of arriving at a knowledge of the causes producing the pestilence that is now hurrying so many of our fellow-creatures to the grave.

In the first place, then, according to fact No. 1, the prevalence of influenza and the spread of catarrhal affections are invariably connected with an excess of ozone in the atmosphere; and since, according to fact No. 3, ozone immediately deprives the most putrid solid or fluid bodies of all disagreeable smell—all animal matters, with the exception of fresh albumen, being rapidly decomposed by it—why, it follows that the presence of an excess of ozone in the atmosphere is utterly incompatible with the presence of a subtle organic poison, produced by the decomposition of animal and vegetable matter; and hence it amounts to a demonstration that the zymotic theory, which attributes the presence of the influenza to the existence of such a poison in the air, is wholly at variance with fact, and must be henceforth abandoned as utterly untenable.

According to facts No. 2 and 4, the prevalence of cholera would appear to be due to a deficiency of electricity, and consequently to a want of ozone in the atmosphere.

Hence, discarding theory, and adhering simply to the bare truth, we may say that influenza and cholera are the two extremes attendant upon an alteration in the normal quantity of atmospheric ozone—the influenza being the peculiar form of bodily disease produced when the atmosphere is plus, and the cholera when it is minus, that particular amount which appears necessary for producing the proper changes in the animal body. That this view approximates very closely to the truth, the peculiar properties of ozone, and the rapid manner in which it acts upon all animal matters, except albumen (Fact No. 3), are another convincing proof.

In influenza, owing to the unusual excess of this principle in the atmosphere, the fluids of the body are undergoing a most rapid change; whereas in cholera, from the inordinate deficiency of the same principle in the air, no change at all takes place—the blood even separates into serum and crassamentum while yet in the living body—and a state of perfect collapse is the consequence.

But it may be said how, if cholera be due to a deficiency, and influenza to an excess, of ozone, how is this fact to be reconciled with the indisputable phenomenon that the same districts are selected by each of them—or, in other words, that the seats of the former are invariably those of the latter disease? This apparent contradiction, however, is but another corroboration of the truth of the explanation. The essential condition of all localities favourable to the development of epidemics is moisture. In this one circumstance all the infected districts agree. They are either situated on the banks of rivers, are low marshy places, or in the immediate vicinity of some source of evaporation. Now, ozone, as was before stated, appears to be but peroxide of hydrogen in an aëriform state; or, in other words, vapour, made by electrical action to combine with another atom of oxygen. Hence, when the atmosphere is unusually charged with electricity, there will necessarily be in all places where there is a large amount of evaporation going on a superabundance of ozone produced by the electrical combination of the vapour with the oxygen of the air; whereas, when there is a deficiency of atmospheric electricity, the moisture will no longer combine with the oxygen, consequently no ozone will be formed; and, the animal fluids remaining unchanged, the serum of the blood will exhibit the same tendency to separate from the crassamentum as if the vital functions had really ceased, while, from the thickening of the blood, and the heart, therefore, failing to receive its natural stimulus, a state of positive collapse, and ultimately death, must necessarily ensue.

The peculiar effect of lightning or electricity of high intensity in preventing the blood from coagulating even after death, and the disposition there is during cholera, when the electricity of the atmosphere is of an extremely low intensity (Fact No. 2), from the serum to be expelled from the system, and consequently for the blood to thicken, may be cited as an additional fact in corroboration of the truth of the above explanation. Again, the extraordinary antiseptic properties of ozone, together with the well-known fact that the primary agent in putrefaction is moisture, and that all antiseptic substances produce their effect simply by removing the water from the zymotic body, and this, coupled with the rapid decomposition which ensues, not only in the human frame after death, but in almost all animal matters in a choleraic atmosphere, appear to afford strong proof that the peculiar and essential conditions of such an atmosphere are at once a deficiency of ozone, and an excess of moisture.

It now only remains to be proved whether the above facts are universal, that is to say, whether they are true in every individual case without a single exception. This, of course, can only be demonstrated by repeated experiments in infected and uninfected districts. The tests for the pre-

sence of ozone and moisture in the atmosphere are exceedingly simple; they have but to be applied in a variety of circumstances, and, if then the phenomena are found to remain unaltered, viz., if the atmosphere of the cholera districts is discovered to be invariably deficient in its normal amount of ozone, then we may almost assuredly congratulate ourselves upon having discovered the cause of this terrible pestilence.

This once achieved, the means of preventing its further progress are perfectly within our command. Should it be found to be really due to a deficiency of ozone, nothing would be easier than to create an artificial supply of this principle.

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THE CHEMICAL TIMES.

SATURDAY, SEPTEMBER 8, 1849.

THE CHOLERA AND THE BOARD OF HEALTH.

A FEW weeks since the Registrar-General expressed, in one of his reports, a confident hope that, as soon as the measures decreed or recommended by the Board of Health should be in full action, the fearful epidemic, against which these measures had been devised, would abate. These cheering anticipations have been most lamentably disappointed; the cholera increases every day in virulence, and there is reason to apprehend that its ravages will finally prove as extensive as they have in Paris.

The measures devised by the Board of Health have thus far proved utterly ineffective, nor is it at all likely that a better result will attend them in future, since not one of them appears to be based upon any rational or intelligible principle. The gentlemen constituting the board seem to have acted throughout in the crassest ignorance of the subject on which their resolutions and decisions were intended to bear;—hence the absurd dietary and remedial prescriptions that have been from time to time issued by the board; and hence also the arrogance with which its official organ has ventured to lecture certain boards of guardians upon their stubborn disobedience to the "orders of the board."

We are truly glad to find that one of the most absurd, as well as most mischievous, of these "orders" has met with considerable opposition on the part of several boards of guardians: we allude to the house-to-house visitation. Had it been the express intention of the Board of Health to "aid and abet" the progress of the cholera, they could not, in our opinion, have hit upon a plan better adapted to answer that purpose than this. Everybody (out of Gwydyr-house) knows that fear constitutes a very powerful element in the generation of the disease. Now, would not this proposed system of house-to-house visitation, if carried into effect throughout the metropolis, inevitably tend to create considerable alarm among the public, and thus, perchance, actually to give rise to attacks of cholera?

The gentlemen of the Board of Health seem to imagine that the great mortality from cholera is in a measure owing to a want of medical assistance. If they *do* think so they are most lamentably mistaken. We rather incline to the opinion that there is *too much* medical assistance, and that a great many more patients would recover if left to themselves. Medical assistance, indeed! It was our sad fate, a few days ago, to witness the "treatment" of an unfortunate individual who had been suddenly seized with a most violent attack of cholera. The first thing prescribed by the surgeon called in to attend the case was, to wrap the body up in a blanket steeped previously in hot water; *eight* more blankets were then heaped upon the sufferer, who lay in a small room, ten feet by nine, and about eight feet high; the air was carefully excluded, though the thermometer stood at 80° at the time. Calomel powders were freely administered, together with *pounded ice*, and iced water. The surgeon left his patient at about two o'clock in the afternoon, and returned at six in the evening, half an hour after his patient had breathed his last. The gentleman in question did not even deem it necessary to convince himself of the fact that life had really fled, but was satisfied with a bare statement to that effect by one of the relatives of the deceased; although he must have been aware that several cases have occurred of late where persons have narrowly escaped being buried alive. Comment upon a case like this would be needless; we can only repeat, the less we have of this sort of medical assistance the better.

If the gentlemen of the Board of Health cannot devise somewhat more rational and efficient measures to check the progress of the epidemic than they have hitherto done, they had much better abdicate their functions and make room for abler men.

THE HEALTH OF LONDON DURING THE WEEK.

[From the Registrar-General's Return.]

The deaths registered in London in the week ending Sept. 1 were 2,796, of which 1,663 were by cholera, 234 by diarrhœa. The mortality exceeds that of any previous week. The greatest number ever registered before in any week since 1840 was 2,454 deaths, in the week ending Dec. 4, 1847, when the last epidemic of influenza prevailed. In the cholera epidemic of 1832, parish clerks, in the old bills of mortality, returned 1,021 burials for the week ending Aug. 28; which, allowing for the defects in their returns, and for increase of population, are equivalent to 2,450 deaths at the present time. The burials after that week in 1832 declined.

The mortality is nearly three times the average of the season, and is sensibly felt all over the metropolis; but the inhabitants of the north and west districts, and people in the distance, can yet scarcely form a notion of the suffering on the south side the Thames, and since the middle of August, in the east districts, "The 12th, 13th, and 14th of August," says one of the registrars of Bethnal-green, "will long be remembered in this neighbourhood, the outbreak of this fatal disease being without any adequate preparation; surgeons are wanted in many places at once; the hurried passing and repassing of messengers, and the wailing of relatives, filled the streets with confusion and wo, and impressed on all a deep sense of an awful calamity."

Cholera has already destroyed, in this epidemic, 9,129 lives in London.

As it is one of the purposes of the Registration Act to ascertain the "causes of death," and of the weekly tables not to gratify idle curiosity, but to point these out to the public, the registrars have been requested to give all the information they can respecting the state of every part of their distaicts. This many of them have taken considerable pains to do, and their notes will, it is hoped, be found serviceable to the guardians and medical inspectors, now and at future times. For it is important to bear in mind that cholera only brings into a strong light the localities which elaborate calculations in the annual reports prove are, at all times, fatal to the health and life of the inhabitants.

After the perils of this terrible week we seem to see land; but as many thousands of lives may be lost in an epidemic by negligence, so many thousands may be saved by skill, vigilance, and energy—by more ample supplies of water—by the rapid removal of nuisances from the houses and streets—by the prompt administration of medical appliances and other comforts, by the active co-operation of the medical profession, of the boards of guardians, of employers, of every householder, of every individual, with the Board of Health, and health officers.

MISCELLANEOUS CORRESPONDENCE.

[To the Editor of the Chemical Times.]

Sir,—I have the misfortune to reside next door to an undertaker, and am constantly annoyed, and, in these times, I may add, alarmed, by an unpleasant effluvium which penetrates my apartments. I have some reason to apprehend it proceeds from dead bodies awaiting interment, and temporarily deposited at my neighbour's.

At the moment of writing this the smell is almost overpowering in the rooms in the front of the house, whilst the rooms in the rear (the farthest removed from the undertaker's premises) are comparatively free from it.

Will you, sir, be pleased to inform me, through the columns of your respected journal, whether I have any, and what, remedy against the evil complained of besides that of removing to a distance, which in my case would be a most inconvenient one?

I have the honour to be, sir, your most obedient servant, A SUFFERER.

Kennington-road, Sept. 6, 1849.

[We advise our correspondent to apply to the police magistrate of the district in which he resides; that functionary will, we doubt not, at once order the immediate abatement of the nuisance complained of, and than which there can be nothing more dangerous to the health and lives of the public.—ED. *Chem. Times.*]

STATE OF GRAVEYARDS IN CLERKENWELL.—In no place is a reform more necessary than in the district of Clerkenwell, where graveyards are completely hemmed in and closely abutted on on all sides by dwelling-houses and workshops, in many cases deriving light and ventilation solely from these pestilential places. The over-crowded and filthy state of them has been made the subject of a Government commission (I alluded to before). Some others (four) are scarcely in a better condition; an examination of them is imperatively necessary. My attention, as district surveyor, has lately been called to the state of the vaults in St. James's Church, where, through quite open gratings, piled in rows, are to be seen coffins seven or eight deep; the graveyard is literally crammed. Strange to say, interments still go on. Extensive workshops are being erected on the adjoining properties. The attention of Government is now being directed to this subject, and the nuisance must be summarily dealt with. Any further interments should be interdicted.—*The Builder.*

STATEMENT IN CONTINUATION OF THE ONE PUBLISHED IN THE CHEMICAL TIMES OF SEPT. 1, 1849, SHOWING THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE AIR FROM AUG. 26 TO SEPT. 1 INCLUSIVE, AS INDICATED BY THE EVAPORATION OF WATER FROM TWO COPPER VESSELS OR SCALES, ONE INSULATED AND THE OTHER NOT. ALSO THE READING OF THE BAROMETER, THERMOMETER, DIRECTION OF WIND, AND GENERAL STATE OF THE WEATHER.

August and Sept., 1849.	Barometer.		Therm.		Scales.				Wind.		General state of weather.
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Insulated	Non-Insulated	Morning.	Evening.	
26	30.10	30.03	67	68	5 I.	20 I.	25	..	NW.	SW.	Generally fine all day; overcast in the evening.
27	30.00	29.95	63	62	20 I.	20 I.	40	..	NW.	NW.	Fine all day, but rather cloudy.
28	29.98	29.95	61	66	15 I.	5 I.	20	..	NW.	W.	Fine morning; overcast afternoon; slight showers at eight P.M.
29	29.90	29.90	66	70	5 I.	..	5	..	NW.	NW.	Overcast and cloudy all day; fine evening.
30	29.88	29.83	68	68	..	..	..	..	S.	SW.	Overcast and cloudy all day; rain evening.
31	29.85	29.85	67	66	5 I.	10 N.	5	10	NW.	NW.	Fine morning; rather overcast all day; fine evening.
1	29.80	29.62	65	68	..	15 N.	..	15	E.	SE.	Rain and overcast all day; thunderstorm from ten to twelve P.M.

From the condition of the atmosphere at the beginning of the week it was to be hoped that the then electrical state of the air would continue: a gradual alteration, however, for the worse has taken place, and, notwithstanding the thunderstorms we have had, there is not at present any appearance of improvement.

Westminster-road, Sept. 4, 1849.

Franklin Coxworthy, Author of "Electrical Condition," &c.

PROCEEDINGS OF LEARNED SOCIETIES.

LIVERPOOL CHEMISTS' ASSOCIATION.

Pharmaceutical meeting, Royal Institution, Colquitt-street, Friday, August 3, 1849. The president in the chair.

Dr. Inman commenced his lecture on the STARCHES OF COMMERCE, of which the following is an abstract:—

The word starch is a generic one, although usually restricted in commerce to one particular variety.

All amylaceous substances are essentially the same in their chemical characters and in their effect upon the animal economy, and the points of difference between any two are comparatively trifling.

Starch is a vegetable product, never being found in the animal kingdom, except when introduced from without. This observation has served Meyen, Ralfs, and others with a means of distinguishing between animal and vegetable life; and had reduced many so-called animalcules to the lowest order of confervæ, desmidiæ. &c.

He then reverted to the organs in which starch is usually found, and pointed out that its use in the vegetable kingdom is to provide nourishment for young shoots or branches before they are able to procure it directly from the soil. It is present also in many of those parts where active changes are taking place; in the stomata of leaves, for example, and at the base of the petiole, and in the adjoining bark prior to the fall of the leaf. The colouring matter of leaves is a modification of starch.

He then spoke of its chemical characteristics. It is coloured blue by iodine, both cold and hot, is insoluble in cold water, and apparently soluble in hot. This solution is not a true one, as he had succeeded under very favourable circumstances in procuring the starch again after it had been subjected to boiling for some time. To succeed in this experiment a great amount of dilution is necessary. The so-called solution is at first very thick and glutinous, but after a while becomes watery and thin; after standing some time the solution precipitates, leaving a clear supernatant liquor. This being tested by iodine showed the existence of a very minute quantity of really dissolved starch.

Though insoluble in hot water alone, the addition of urine, and of some neutral salts, enables the greater part of the starch to be taken up—a small precipitate is left, consisting of the remains of the granules unacted on by either. This is the reason why urine is used so much in those processes of dyeing where starchy substances are employed to make the stuffs take the colours better.

In chemical composition starch is closely allied to sugar—into which it is readily converted by the action of saliva in the animal kingdom, and by germination or growth in the vegetable.

When examined by the microscope, starch is found to consist of granules of various sizes. Each granule has a point called the hilum, round which a number of irregularly concentric ellipses or circles are marked.

The size of the granule, the position of the hilum, and the distinctness of the concentric lines, vary in different species of plants.

After describing the characters of many of the principal farinas, or starches of commerce, he observed that they might be divided into two classes, those with large granules, and those with small. In the former he placed the potato and wheat starches, and the tous-les-mois. In the latter he placed the different arrowroots, sago, rice, barley, Indian meal, millet, and a variety of others. Any adulteration of arrowroot with the farinas of the first class he considered could be at once detected by the microscope; but he doubted if that instrument would throw any light upon its adulteration by sago, rice, or other farina with small granules.

There has been much discussion as to the true nature of the granules of starch, some contending that they are enveloped in a membrane, and others that there is no distinct capsule. After a careful consideration of the subject, he had come to the conclusion that there was some truth in both theories. There are two distinct substances in each grain, one which is readily acted on by water, the other which is not: in most cases the latter forms an outside coating, and looks membraniform; but in some, as the wheat and sago for example, the denser portion appears to have a different arrangement, and may be seen as a ring, a coil, or as divergent rays.

Double granules are occasionally found, which are accounted for by supposing two nuclei being in opposition at one of their margins, and becoming united together by additional layers.

He then drew attention to solutions of different forms of farina, all of which were of the same relative proportion with regard to the weight of starch and water employed. It appeared that potato starch made the thickest solution, but was the first to become thin; that no essential difference could be detected between the Bermuda arrowroot, the Tahiti, the St. Vincent, the tous-les-mois, and the tapioca. All the other starches were very thin and watery.

He then adverted to the value of starch as food; noticed the difficulty of its digestion when taken cold and uncooked, and its ready dissolution in the stomach when taken after boiling; adverted to the influence of torrefaction in rendering the grains more digestible, and explained thus the advantage of baked flour over raw flour in preparing infants' food.

There are differences to be detected in the digestibility of the various farinas. Potato starch is usually considered to produce flatulence and disposition to diarrhœa, while arrowroot is considered to induce a tendency to constipation. On the whole, tapioca appears the best food for infants. No decided rule could, however, be laid down with respect to this, as each stomach appears to have an idiosyncracy of its own.

After a few words upon the preparation of starch, and the necessity there was for its being always thoroughly washed from any adhering vegetable matter, the lecturer concluded by observing that he considered that all the arrowroots, the tous-les-mois, and the tapioca, were of equal value as dietetics; that their difference in price was by no means a criterion of their respective goodness; and he would recommend those with limited means to purchase a large quantity of low-priced arrowroot (say St. Vincent or South Sea) rather than a small quantity of the best Bermuda.

Dr. Inman then exhibited a number of starches under his powerful microscope.

CALIFORNIA IN IRELAND.

[From "The Pharmaceutical Journal"]

Much interest has been recently excited by the announcement of the discovery of a process by which the bogs of Ireland may be made as prolific of treasures as the gold regions of California. The following report of a discussion on this subject, which took place in the House of Commons on the 27th of July, is extracted from the *Times*:—

"Mr. O'Gorman Mahon took the opportunity of announcing a discovery of great importance relative to the development of the resources of Ireland, and which would materially enhance the value of landed property there; namely, that by a new process of distillation the millions of acres of peat might be made to yield chemical and other principles of much value. He produced a spermaceti looking candle, which he warranted to be of genuine peat matter, and which burnt brilliantly on the table during the evening.

"Lord Ashley had been assured by Mr. Owen, to whose character he bore the highest testi-

mony, that the results of his experiments upon thousands of tons of peat had proved that, for an outlay of £20 for cost and labour, 100 tons would afford carbonate of ammonia, soda, naphtha, a substance adapted for candles, camphine oil, and other products, worth £91."

The bogs of Ireland are estimated at 2,800,000 acres, or nearly one seventh of the entire surface of the island; and it has long been a subject of speculation whether these immense tracts of land could not be made to contribute to the improvement of the condition of the Irish people. Before alluding to the several means which have been suggested for that purpose, it may be well briefly to describe the general character of Irish bogs, and the supposed causes of their formation.

Bog consists of a mass of vegetable matter in different stages of decomposition. It is supposed to owe its formation, in the first instance, to the accumulation of moisture, and other conditions favourable to the growth of mosses, especially of certain species of sphagnum. These and other aquatic plants, which absorb large quantities of water, form beds, on the surface of which new plants take root, and thus, by the addition of successive strata of vegetable growth, the bog often acquires considerable thickness; and, according to its thickness, age, and other circumstances, it presents different characters. Near the surface it is generally light-coloured and spongy, the vegetable remains having undergone but slight alteration. At greater depths it is darker coloured, denser, and in a more advanced state of decomposition; and in some cases, at the bottom of old and deep bogs, it is black, and nearly as dense as coal.

These beds of vegetable remains sometimes extend to a depth of forty feet; and even those on the summits and sides of mountains are in some instances ten or twelve feet in thickness.

The chemical composition of bog, when in a tolerably advanced state of decomposition, is not very different from that of coal; but it contains a larger amount of incombustible matter, and, according to Sir Robert Kane's experiments, a much smaller proportion of nitrogen. It differs remarkably, however, in one respect from coal, and that is, in the proportion of water which it contains. Undried peat, that is, the bog cut for use as fuel, generally contains about 25 per cent. of water.

Bog, in the form of peat, has long been used as fuel, its calorific power being about half that of coal; but there is this great defect in peat fuel, that in consequence of its light and porous character the heat obtained by its combustion is too much diffused for many purposes. This defect has to a great extent been remedied by submitting it to mechanical pressure in hydraulic presses. It has been found that the peat may be thus condensed to about one third its volume, and at the same time deprived of much of its water. Even compressed peat, however, is incapable of producing heat of much intensity in ordinary furnaces; but its property in this respect is greatly improved by converting it into charcoal. The charcoal of condensed peat is said to be of very excellent quality, its density being greater than that of wood charcoal. Even uncondensed peat affords very good charcoal for combustion, and for other purposes, which we shall have occasion to notice.

It is in the carbonization of peat that experimenters have discovered the most feasible means of turning the bog to profitable account. In converting peat into charcoal, a considerable part of the organic constituents are driven off in the form of volatile but condensible products, the nature of which will vary according to the circumstances under which the carbonization is effected. By conducting the process in such a way as to produce the greatest amount of valuable products, and by judiciously applying these products, it is conceived by certain parties who have directed their attention to the subject that the bogs of Ireland may be made a source of wealth to the inhabitants of that country. Several processes have been proposed for this purpose. The method originally adopted consisted of heating the peat in iron cylinders exposed to the heat of a furnace, in much the same way as coal is treated for the production of gas. But, in making gas from coal, the object is to get a large proportion of the constituents of the fuel in a permanently gaseous condition, while in the carbonization of peat it is important to obtain condensible products to as great an extent as possible. The nature of the products of the distillation depends in a great measure upon the temperature to which the fuel is exposed. If the distillation be conducted at a low temperature, the fuel will yield much tar and comparatively little gas. Even the nature of the tarry product varies according to the temperature at which it is produced; so that there is some scope for the exercise of skill and ingenuity in devising the best method of operating.

In submitting peat to destructive distillation in apparatus similar to that of the gas works, no more heat being applied than is necessary to ensure complete carbonization, the products consist of a porous charcoal, which remains in the retort, and of an aqueous liquor and tarry matter, which are collected in the condensing apparatus. We have seen this process conducted, and have examined the products.

The aqueous liquor is generally neither acid nor alkaline. Sometimes, however, it contains a little acetic acid, and more rarely ammonia is detected, but in very small quantity.

The tarry matter differs from coal-tar; it is much thicker, being of the consistence of butter, and of a brown colour. In proportion as the heat applied in the process is more intense, the tar assumes a thinner consistence and a darker colour.

The charcoal is rather light and porous, but it is quite equal in calorific power to common wood charcoal or gas coke, and for some purposes it possesses advantages over those fuels. It burns freely without smoke, and, when used in an open fireplace, affords a teady, clean, and cheerful fire, which is unaccompanied by the crackling of a common charcoal fire. This charcoal has been advantageously employed for deodorizing night-soil and preserving it for agricultural use.

This process for the conversion of bog into available products has been in operation, or at least a manufactory for the purpose has been in existence, in this country for several years past. The locality selected for trying the project was Dartmoor, and the speculators were principally inhabitants of the neighbouring town of Plymouth. A capital of £20,000 was raised, which has been spent in the construction of works, and in a vain attempt to realize the sanguine anticipations of the projectors. We understand that the works have now passed into the hands of a new company, and that there is not a shilling left for the original shareholders. The failure of this undertaking has, by some, been ascribed to injudicious management, and extravagant expenditure of the capital in the construction of apparatus which, when used, proved inapplicable for the purpose intended. There are others, however, who consider that the object contemplated cannot be advantageously effected by a process of distillation, such as that adopted at Dartmoor.

The new method of carbonizing peat, to which allusion was made by Lord Ashley in the House of Commons, as noticed at the commencement of this article, is the invention of Mr. Reece, a young chemist, who has been working for several years in the laboratory of M. Pelouze, in Paris, where the investigations upon which this process has been founded were conducted.

On the 23d of last January Mr. Reece specified a patent, sealed six months before, for a method of burning turf or peat, and condensing the volatile products. The patentee does not lay claim to any particular form of apparatus, but he claims—1. The employment of a blast of hot or cold air in a proper furnace for the combustion of peat, so as to be enabled to condense the volatile products in a vessel adapted to that purpose. 2. He claims a mode or modes of treating the volatile products, named respectively, paraffine, and paraffine oil, so as to separate them, and render the paraffine pure enough to make candles. The first object is effected in a furnace similar to a common German stove, in which he forces in the air-blast beneath the grate, to be ultimately passed out at the exit end of a zigzag condenser, which is laid nearly flat, in a vessel filled with cold water. He thus condenses the paraffine, oil, and other liquids, but permits the gaseous matters to pass off into reservoirs, from which they can be conducted in pipes and burned, with the view of applying heat to any subsidiary uses. The second part of the process consists in redistilling the liquid produets, so as to separate the concrete and less volatile paraffine from the fluid solvent oils. This paraffine is to be purified by repeated distillations, and by pressure in a stearine press, and finally by a kind of sublimation (or distillation), till it becomes pure and white enough to make candles.

The patentee states, that by this process, in which the peat is exposed to a lower and more equally diffused heat than that which is required in operating in the way previously described, the volatile products obtained are different and more valuable. Among these products is ammonia, which is rarely obtained when the peat is distilled in retorts heated from without. He states also that the paraffine is an abundant constituent of the tarry matter, and that this may be economically purified by his process so as to render it fit for the manufacture of candles.

The principal point of novelty in Mr. Reece's patent is the introduction of air into the kindled peat, in order to carry on, as would appear, a sort of semi-combustion, by which sufficient heat is generated to cause distillation, while there is not sufficient oxygen supplied to consume the fatty, oleaginous, and ammoniacal products.

This new project has been taken up by Mr. Owen, a respectable linendraper in Great Coram-street, and other men of capital, who are providing the means for submitting Mr. Reece's process to a practical test.

It is a remarkable fact that the Plymouth speculators in the distillation of bog were mostly linendrapers. We hope Mr. Owen and his friends, profiting from the experience of their brethren, will be more cautious and prudent in the expenditure of their capital, and more successful in the result of their speculations.

STERLING'S PROCESS OF MAKING AMBER VARNISH.

In manufacturing amber varnish according to Mr. Sterling's method, the amber (which has to be submitted to high temperature to melt it) is introduced into a stout copper vessel, which is closed at top and luted with clay. This vessel is furnished at its lower end with a funnel-shaped vent, which carries a perforated sheet of iron or sieve, sufficiently fine to prevent the escape with the melted amber of any impurities which might be contained in the amber. This vessel is introduced into a large chafing-dish fixed upon a high stand, and its tapering bottom projects through a hole in the bottom of the chafing-dish, and extends a few inches downwards. When the vessel is thus adjusted, the chafing-dish is nearly filled with coal and lighted. The fuel is, by the peculiar form of the chafing-dish, prevented from dropping into the oil vessel, to be presently described, and thereby soiling the liquid.

The heat from the ignited fuel very soon heats the vessel to such a temperature as will melt the amber and cause it to flow through the perforated metal or sieve above mentioned, in passing through which it will be purified from all extraneous matters. The melted amber runs into a copper vessel which is placed below the chafing-dish, and is provided with a long handle. This

vessel or receiver is filled about two thirds full with the oil from which it is intended to prepare the varnish, and is placed upon an ordinary chafing-dish charged with incandescent fuel, which heats the amber to such a temperature as to cause it to become incorporated with the oil. When this is completely effected, the vessel is cleansed for a fresh operation, and the other ingredients necessary for the manufacture of the varnish are added to the mixture of oil and amber, as soon as it has cooled down to a suitable temperature.

These very simple means present the following important advantages over those now in use for the manufacture of varnishes:—

1st. The amber melts completely without any residuum; and, as it is contained in a perfectly tight vessel, nothing, or next to nothing, is lost by the evaporation of its constituent parts.

2d. The application of a high temperature effects the fusion with ease and rapidity.

3d. This mode of preparing varnishes is perfectly free from danger as regards fire. The amber is contained in a perfectly close vessel, and cannot, therefore, take fire, especially as the air has no access through the spout through which the melted amber flows. Neither will the oil through which the melted amber flows be liable to take fire, for it does not require to be heated to a very high temperature, as is at present the practice,—the amber being now melted and dissolved in oil heated to the point of violent ebullition. And further, the chafing-dish is small, and it is impossible it can communicate to the vessel filled with oil (which is of much more considerable capacity) sufficient heat to cause a fear of fire.

4th. All the vessels are of stout copper, and consequently are not liable to burst, as is the case with the earthen ones, which are at present too often employed.

It will thus he seen that, independently of the practical advantages which this method of manufacturing varnish (and which has already stood the test of long experience) possesses over those ordinarily in use, it has the important one of being unattended with danger.—*Technologiste* and *Newton's London Journal.*

ON THE PREPARATION OF NITROGEN.

By M. B. CORENWINDER.

The preparation of nitrogen is attended with many inconveniences. Of the several processes which are adopted in laboratories there is not one by which it can be obtained rapidly and in a state of purity, unless much precaution is taken, and complicated apparatus employed. This circumstance has induced me to publish a process by which I prepare, in a few minutes, an abundant supply of the gas, and in a state of absolute purity, as is proved by the results about to be given.

This process is founded on the decomposition of nitrite of ammonia, which, as is already known, is resolved into nitrogen and water under the influence of heat; but, as this salt is difficult to prepare, I replace it by a mixture of an alkaline nitrite of potash and sal ammoniac, a mixture which contains the elements of nitrite of ammonia and chloride of potassium.

The best method of obtaining the nitrite of potash in a convenient state is to pass nitrous acid gas, formed by the action of ten parts of nitrie acid on one part of starch, through a solution of caustie potash having a specific gravity of 1.38, until the solution acquires an acid reaction; and then to add a little caustic potash, so as to render it distinctly alkaline. As the solution thus prepared does not undergo alteration from keeping, it may be kept in readiness; and, when the nitrogen is required, it is only necessary to mix one volume of the above solution with three volumes of a concentrated solution of sal ammoniac, and to heat the mixture in a flask. The disengagement of the gas takes place almost immediately, and continues with great regularity.

As it is necessary, in order to have the gas pure, that the nitrite should be alkaline, there will be a disengagement at the same time of a little ammonia, but this is of no consequence; if the nitrogen be required completely free from ammonia it is sufficient to pass the gas through a vessel containing water acidulated with a little sulphuric acid.

The following are the experiments by which I have satisfied myself of the purity of the nitrogen thus obtained:—

1. After freeing the gas from ammonia, as above described, it was conveyed into a tube containing a mixture of zinc, sulphurie acid, and water—into the presence, therefore, of nascent hydrogen. The experiment was continued for some time, and when concluded I could not detect a trace of ammonia in the solution.

The result was also negative on testing it with sulphate of iron and dilute sulphuric acid.

2. I placed in a glass tube, such as is used for organic analysis, a determined quantity of copper recently reduced by hydrogen, and exposed this for half an hour to the action of a red heat and of a current of the nitrogen washed and subsequently dried by passing it through pumicestone wetted with oil of vitriol; taking at the same time the precaution not to heat the tube until all the atmospheric air had been displaced by the nitrogen. This experiment was repeated several times without any alteration being observed either in the exterior appearance of the copper or in its weight.—*Annales de Chimie et de Physique.*

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

George Fergusson Wilson, of Belmont, Vauxhall, gentleman, for improvements in separating the more liquid parts from the more solid parts of fatty and oily matters, and in separating fatty and oily matters from foreign matters. Patent dated February 28th, 1849. Enrolled August 27th, 1849.

This invention relates to an improved mode of separating the more fluid or semi-fluid parts from the solids of fatty matters, and also to the separating fatty or oily matters from the crushed matrix, such as cocoa, and other similar substances; it is also applicable to the separating extraneous particles from fatty or oily matters.

The mode of procedure is similar to that of drying clothes, in which they are subjected to rapid rotary motion, by being enclosed in a drum or casing, having a periphery of wire gauze; the clothes, or other articles, by the centrifugal force, being thrown against the wire cloth, while the water is projected through the meshes, leaving the clothes in a dry, or nearly dry, state. The machine the patentee prefers for the purpose is that known as Seying and Co.'s; but, in lieu of the wire cloth, a thickness of strong cotton twill is substituted, which permits the passage of more fluid parts of the fatty matters, yet, at the same time, retains the solid portions thereof. In order to prevent the pores of the cloth from being closed with the fat, or the surface from being coated, the patentee encloses the matter to be operated upon in a long canvas bag, of a length that will just pass once round the rotating drum. On rapid rotary motion being imparted to the machine, the more fluid portion passes through the bag, and also the periphery of the drum, in like manner to the water in drying clothes. By the centrifugal force the more solid parts of the fatty matters are thrown against that side of the bag next the periphery, preventing the escape of the fluid part on the other side; in order to effect which the patentee turns the side of the bag next the centre towards the circumference, repeating the operation as before. In no case should the speed of the machine be such as to separate the stearine or stearic acid from the fatty matters under operation.

This process is also applicable to the separation of sand, or other extraneous particles, from fatty matters, or for separating the more fluid portions of fatty matters that have been subjected to cold and become solid. For this purpose the patentee raises the temperature of the room in which the operation is conducted two or three degrees above that at which these solids will again become fluid, which admits of their separation in the manner described. This is also applicable to the removing the oily or fatty matters from the crushed matrix of nuts, such as cocoa and other similar substances; the temperature of the room, in this case, being raised ten degrees above that at which the fatty matters dissolve.

Having described his invention, the patentee wishes it to be understood that he does not claim the machinery or apparatus employed, as the same has before been used for other purposes; but that what he does claim is, the mode of separating the more liquid parts from the more solid parts of fatty and oily matters, and separating fatty and oily matters from foreign or extraneous matters, as described.

Don de Bourcicault, of the Quadrant, Regent-street, gentleman, for certain improvements in the mode or modes to be used for transmitting and distributing liquids and fluids for agricultural purposes, and for apparatus connected therewith. Patent dated February 28th, 1849. Enrolled August 28th, 1849.

These improvements have reference to the irrigation of land for agricultural purposes, or for the distribution of fluid manure, or it may be gases, as such may be hereafter found to produce a beneficial effect on the land for raising crops. In carrying out this invention, the patentee proceeds to prepare the land in a very similar manner to that required in thorough drainage, by cutting trenches across the land, at distances varying from six to twenty feet; but he does not restrict himself to that distance, as other distances may be found desirable in some districts. These trenches must be cut to a depth of from eighteen inches to three feet, according to the capillary attraction or power of the soil in absorbing fluids, but must in all cases be below the depth to which any implement of culture passes. Should the land be level, then one uniform depth must be observed, as it is necessary that the bottom of the trenches should be on the same level. The whole of these trenches are then intersected by one main trench, placed in connection with a reservoir containing the fluid to be distributed, which must have a sufficient altitude to cause the fluid to flow freely throughout the main trench. The trenches so cut are then filled throughout with drain or other tiles, and partially filled with coke or some other suitable substance, similar to the use made of stones in thorough drainage, which prevents the fluid flowing too rapidly through the several drains, yet, at the same time, without creating too great an obstruction or actual stoppage in the trenches. The earth dug from the trenches is then returned, and the surface prepared at another part. The fluid, on being admitted to the main trench, is distributed equally throughout the whole trenches that divide the land into sections, and these being on a level the whole will be evenly distributed, and, having free access to the soil, will be absorbed or carried up to the surface, over which it will be carried by the capillary attraction of the soil. When land to be irrigated or manured is not on a level, the patentee first prepares it by what he denominates contour levelling, that is, levelling it in parts or in such areas as the nature of the land will admit, which areas are then severally trenched as described, each set of trenches on a different level having one main trench communicating therewith, which main trench is again in communication with the duct by which the fluid is transmitted from the reservoir; this duct or trench has such an inclination as will suit the general level of the land, and meet the different main trenches, the flow being partially stopped at such places where it would be rendered too

fast by reducing the size of the passage at such places, or partially stopping it with coke or some other similar substance. The fluid, on being admitted to the main trench, would be distributed to the land in a similar manner to that described. When it is desired to distribute gases lighter than the atmosphere to the land, the only difference will be, that the reservoir, instead of being on a higher level than the trenches, as described, must be lower, so that the gas in passing into the trenches will have a gradual ascent, in order to ensure its equal distribution. In case of the gas being heavier than the atmosphere, it must of course have the reservoir on the higher level, as in water or other fluids.

The patentee claims the transmitting and distributing of fluids or liquids on land, for agricultural purposes, in the manner hereinbefore described.

Benjamin Biram, of Wentworth, in the county of York, gentleman, for improvements in miners' lamps. Patent dated February 28th, 1849. Enrolled August 28th, 1849.

This specification describes improvements in the mode of constructing miners' lamps. The objects to be effected by the patentee being to increase the illuminating power of the lamp; also to allow access to the interior of the lamp only by means of a key; the door or opening to it being secured by a padlock. The general appearance of the lamp greatly resembles that of the "Davy" lamp. The chimney may be either of sheet metal or of wire gauze; but when of sheet metal a cap of wire gauze is to be attached, to allow the escape of the products of combustion. The oil chamber in which the wick is placed is so constructed as to slide in and out of the lamp, through an opening in the front, which is closed by a door sliding in well-fitted grooves, in a vertical direction, and fitting as nearly air-tight as practicable. The part of the door opposite the wick is provided with a sheet or pane of talc, through which the light is thrown by a reflector placed behind the wick, and mounted upon the oil vessel. The lower part of the door is provided with a piece of wire gauze, through which the air required to support the combustion of the wick passes. The patentee states that in lieu of the pane of talc in the door a piece of wire gauze may be substituted, but he prefers the employment of talc. When the vertical sliding door is placed in its position in the grooves, and thereby closes the opening into the lamp, it is there secured in the following manner:—A ring is placed upon the lower part of the chimney in such a manner that it can be turned round upon the chimney, but cannot be lifted; a projecting pin upon the ring passing over the top of the sliding door thus prevents it from being withdrawn from the grooves, and when in this position it is secured by a padlock, the hasp of which passes through an eye upon the ring, and through another eye upon the chimney of the lamp; and, when the door is required to be withdrawn, the padlock is removed, and the ring shifted round till the projecting pin passes from above the top of the sliding door. The door can then be removed, and access obtained to the interior of the lamp. There is a pricker which passes through the back of the lamp-case, and also through the reflector to the wick, so that the wick may be raised, lowered, or trimmed, without the necessity of opening the lamp. The pricker passes through a ball and socket joint attached to the case, and is accordingly capable of being moved in almost every direction. The patentee states, that when it is required to employ the lamp in an atmosphere highly impregnated with carburetted hydrogen or other deleterious gases, then, in lieu of the pieces of wire gauze in the bottom of the sliding door, a circular simple aperture is employed, to which is attached any desired length of vulcanized indiarubber, or other flexible tubing, by which a communication is effected between the interior of the lamp and an atmosphere capable of supporting combustion, and the wick supplied with it.

The patentee claims:—First. The combination of a reflector with a burner or wick in miners' lamps.

Secondly. The combination of a reflector and burner with a door made partly of talc, and partly of wire gauze, or wholly of talc.

Thirdly. The combination of parts for preventing access to the interior of the lamp without the aid of a key.

Fourthly. The employment of a pricker for raising, lowering, or trimming the wick, as described.

Fifthly. The combination with miners' lamps of a circular aperture, and tube, of vulcanized indiarubber, for carrying fresh air to the interior of the lamp.

James Webster, of Basford, in the county of Nottingham, engineer, for certain improvements in apparatus for manufacturing gas. Patent dated February 8th, 1849. Enrolled August 6th, 1849.

This invention purports to have for its object the manufacture of gas of a quality which renders unnecessary the process of purifying resorted to in the manufacture of gas from coal. The gas manufactured by the patentee's process is asserted to be free from deleterious admixture, and forms a cheap substitute for common gas. These advantages the patentee affirms are derived from the use of a flat-bottomed retort, divided into three compartments by suitable divisions, for the purpose and action of the fire heat; for the decomposition of the materials used is effected only on the flat bottom or under side of the retort. The base from which the gas is generated being rosin, the gas is free from the impurities which render common gas injurious to the consumer.

The apparatus employed consists of a rectangular chamber or retort, set over a fireplace or furnace. This retort is of considerable depth, and divided into three compartments by partitions, one of which depends from the top and reaches within a short distance of the bottom, while the other is carried upwards from the bottom till within a short distance of the top. In the two extreme divisions of the retort are gratings, placed on a level with the under edge of the partition depending from the top, and on which a quantity of coke is placed, so as to fill the compartments about two thirds, or within a short distance from the top. On the top of the retort are placed two reservoirs, one containing naphtha, the other rosin. A pipe conveys a supply of naphtha into the first compartment at the bottom, by which, on coming in contact with the heated surface, a gas is generated, which rises up in that compartment through the coke, passes over the first partition, and takes a downward course. In the central compartment a number of rods or bars of iron are suspended, on which a supply of rosin is delivered at the top, and diffused over the surface of the bars, and with which the gas evolved from the naphtha comes in contact and absorbs the rosin, which, passing downwards, impinges on the heated bottom of the retort, which converts it into bicarburetted hydrogen. The gas then passes upwards through the third compartment containing coke, and away by a pipe, to what the patentee terms a condenser; this consists of a vessel having transverse partitions reaching from the top partially down, and so as to be immersed in the naphtha contained in that vessel; the gas is introduced successively to the several compartments; in the first of which it is caused to pass below the surface of the naphtha which contains the undecomposed particles. In the other two compartments of this vessel the gas simply impinges on the surface of the naphtha, and is conveyed away by a separate pipe from the same compartment. After having entered these chambers the gas is fit for immediate use, and may be transmitted at once to the gasometer for consumption. The condenser is fitted with a syphon-pipe. Suitable apertures are formed in the retort for cleaning its several divisions as required. The rosin in the reservoir on the top of the retort is kept in a melted state by the heat of both the retort underneath and the gas discharging-tube, which passes directly through it.

No specific claims are appended to the specification.

Invention of Suspension Bridges by the Chinese 1,600 Years Ago.—The most remarkable evidence of the mechanical science and skill of the Chinese at this early period is to be found in their suspended bridges, the invention of which is assigned to the Han dynasty, according to the concurrent testimony of all their historical and geographical writers. Shang-Leang, the commander-in-chief of the army under Kaou-Tsoo, the first of the Hans, undertook and completed the formation of roads through the mountainous provinces of Shen-se to the west of the capital. Hitherto its lofty hills and deep valleys had rendered communication difficult and circuitous. With a body of 100,000 labourers he cut passages over the mountains, throwing the removed soil into the valleys, and, where this was not sufficient to raise the road to the required height, he constructed bridges which rested on pillars or abutments. In other places he conceived and accomplished the daring project of suspending a bridge from one mountain to another across a deep chasm. These bridges, which are called by the Chinese writers very appropriately "flying bridges," and represented to be numerous at the present day, are sometimes so high that they cannot be traversed without alarm. One still existing in Shen-se stretches 400 feet from mountain to mountain, over a chasm of 500 feet. Most of these "flying bridges" are so wide that four horsemen can ride on them abreast, and balustrades are placed on each side to protect travellers. It is by no means improbable that, as the missionaries in China made known the fact more than a century and a half ago that the Chinese had suspension bridges, and that many of them were of iron, the hint may have been taken from thence for similar constructions by European engineers. — *Thornton's History of China.*

TO CORRESPONDENTS.

"Messrs. Smiths and Co., Edinburgh."—We will inquire, and communicate the result to you. It is our impression, however, that the filtering apparatus alluded to is not procurable in this country.

"Mr. George Harris."—Our correspondent's question is too vague. We must request him to point out the passages wherein the references alluded to occur.

"R. D. C."—You will find the desired information in Dumas' "Chimie Appliquée aux Arts."

"A Patentee."—You have no remedy.

"P. C."—We do not think the commissioners will remit the penalty. However, you may try.

"Mr. Whitman, Chelsea," is referred to Nos. 142 and 149 of the *Chemical Times*.

"P. T."—Marshall's cerate is prepared as follows:—Take of palm oil and calomel, of each two ounces; sugar of lead, one ounce; ointment of nitrate of mercury, four ounces. Mix thoroughly by rubbing the ingredients together in a Wedgewood mortar.

"P. R."—The so-called currant coffee is prepared from the seeds washed out of the cake left in making currant wine.

"X. Y. Z."—We cannot advise you in the matter.

"Mr. Dunn, Birmingham."—Iron castings may be bronzed by thorough cleaning, and subsequent immersion in a solution of sulphate of copper, when they acquire a coat of the latter metal. They must then finally be washed in water.

"Tyro."—Use acid of 1.1. specific gravity.

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ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXXIII.

(LECTURE CVI.)

VEGETO-ALKALIS—(*Continued*).

SABADILLA.

Sabadilla is the fruit of the Veratum sabadilla, of Mexico, a plant belonging to the tribe of the Colchicaceæ.

It contains :—

Fatty matter,
Sabadic acid,
Wax,
Acid gallate of veratria,
Yellow colouring matter.'

The medicinal properties of sabadilla are to be attributed to the veratria which that plant contains.

The sabadic acid is a white, volatile substance ; it crystallizes in nacreous needles, has a faint smell, and fuses at 68° Fahr.

Merck has discovered another acid in sabadilla, to which he has given the name of veratric acid, and which belongs to the series of the fatty volatile acids.

SABADILLA POWDER.

The pulverization of sabadilla requires great caution. The contact of the smallest quantity of the powder with the mucous membrane of the nose excites violent fits of sneezing.

The powder of sabadilla is vulgarly known by the name of powder of the Capuchins. It is used to kill lice.

SABADILLA CLYSTER.

Take of Sabadilla, 8 grammes.
Water, 320 grammes.
Milk, 350 grammes.

Boil the sabadilla in the water until the quantity of the fluid is reduced to two thirds. Strain, and add the milk.

This clyster is administered mostly for the purpose of killing ascarides.

TINCTURE OF SABADILLA.

Take of Sabadilla, 1 part.
Rectified alcohol, 2 parts.

Macerate for eight days. Strain.

This is Dr. Turnbull's formula. He uses this tincture in the same cases in which he exhibits the preparations of veratria.

EXTRACT OF SABADILLA.

Take of the preceding tincture, any quantity you require.

Evaporate to the consistence of an extract.

Dr. Turnbull exhibits this extract in neuralgias, in the form of pills, at the dose of one milligramme.

Treated with alcohol at 31° Cent., sabadilla yields the one fifth its weight of extract.

WHITE HELLEBORE.

White hellebore is the root of Veratrum album (Colchicaceæ). It has the same properties as the bulbs of colchicum.

It contains veratria and another organic base, jervina, which latter was discovered by M. Simon.

The formula of jervina is, according to Will,

$$C_{60}H_{45}N_1O_3.$$

Jervina is a white, crystalline, readily-fusible substance. It is sparingly soluble in water, but dissolves very readily in alcohol. With the sulphuric, nitric, and hydrochloric acids it forms very sparingly soluble salts. In this respect jervina differs most materially from veratria, the salts of the latter being readily soluble. It is upon this difference of solubility of the respective salts of veratria and jervina that Simon has based his process of separating the two bases from each other.

POWDER OF WHITE HELLEBORE.

Reduce the root to powder, without leaving a residue.

POMATUM OF WHITE HELLEBORE.

Take of Powder of white hellebore, 4 grammes.
Hogslard, 32 grammes.
Essence of citrons, 3 drops.

Mix.

M. Biett has exhibited this pomatum in some cutaneous diseases.

LOTION OF WHITE HELLEBORE.

Take of White hellebore, 15 grammes.
Water, 1 quart.

Boil, strain, and add to the strained decoction
Tincture of white hellebore, 125 grammes.

Swediaur recommends this lotion against prurigo and scurf.

TINCTURE OF WHITE HELLEBORE.

Take of Dry root of white hellebore, 1 part.
Alcohol at 56 Cent., 5 parts.

Macerate for eight days ; strain with expression, and filter.

WINE OF WHITE HELLEBORE.

Take of White hellebore, 1 part.
White wine, 15 parts.
Alcohol at 56 Cent., 1 part.

Let the hellebore macerate in the alcohol for twenty-four hours ; add the wine, and let the mixture stand for a few days. Filter.

COLCHICUM.

The bulbs of colchicum (Colchicum autumnale) contain :—

Fatty matter,
Volatile acid,
Gallate of colchicina,
Gum,
Starch,
Inulin,
Lignin.

The leaves of colchicum (and, indeed, of the Colchicaceæ in general) partake of the acridness of the other parts of the plant ; they are hurtful to cattle.

The flowers of colchicum have analogous properties to those of the bulbs. Some physicians prefer them to the latter, on account of the greater mildness of their action.

The existence of colchicina was established by Geiger ; Caventou and Pelletier had confounded it with veratria.

Colchicina crystallizes in slender needles ; it is inodorous ; it has a bitter taste. A small dose of it produces vomiting and purging. It is not quite so acrid as veratria, nor does it exercise the peculiar action of the latter upon the mucous membrane of the nose. It is, moreover, slightly soluble in water, whereas veratria is insoluble in that menstruum. It dissolves in alcohol and in ether. It combines with acids, and forms with them salts, most of which are crystallizable. The salts of colchicina are bitter and acrid. Sulphuric acid imparts a blue colour to them. Infusion of gallnuts precipitates colchicina and its salts.

PREPARATION OF COLCHICINA.

Crush the seeds, and macerate the crushed mass with alcohol acidulated with sulphuric acid. Add lime, filter, and saturate the filtrate with sulphuric acid. Distil the alcohol off. Decompose the residuary liquid with carbonate of potass, collect and dry the precipitate produced, and redissolve it subsequently in absolute alcohol. Decolorate with animal charcoal, and concentrate to crystallization.

Colchicina is a very poisonous substance. It produces violent inflammation of the stomach and intestines.

The bulbs of colchicum are used against dropsy and gout.

The preparations of colchicum unquestionably check the paroxysms of gout ; but, unfortunately, the attacks recur afterwards more frequently than ever. The effect which the preparation of colchicum produces in gout is therefore, after all, anything but beneficial ; and it is by no means advisable to exhibit these preparations in preference to veratria, as has been recommended by some authorities.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON THE INORGANIC CONSTITUENTS OF ORGANIC BODIES.

By H. ROSE,
Professor of Chemistry in the University of Berlin.

[*Continued from page* 165.]

APPENDICES TO PROFESSOR ROSE'S PAPER.

APPENDIX III. and IV.

EXAMINATION OF THE INORGANIC CONSTITUENTS OF RAPE-SEED AND RAPE-STRAW. BY M. WEBER.

Aqueous Extract.—The following are the percentage results :—

	Rape-seed.	Straw.
Chloride of potassium	1.39	3.82
Chloride of sodium	..	9.71
Potash	67.88	58.91
Lime	..	0.32
Phosphoric acid	12.84	...
Sulphuric acid	2.08	1.86
Carbonic acid	11.11	25.32
Silica	1.21	1.47
	96.51	100.41

On calculating the salts from the constituents obtained, a very large amount of free potash remains in excess, which existed in the evaporated residue as hydrate of potash. The apparently considerable loss arises from the waters of the hydrate of potash not having been given among the constituents. Moreover, on account of the large amount of fatty oil in the seeds, a very large quantity of olefiant gas was evolved during the carbonization, and this caused the conversion of so large an amount of carbonate of potash into potash.

The above constituents, when calculated as salts, yield the following composition :—

	Rape-seed.
Chloride of potassium	1.32
Tribasic phosphate of potash	38.19
Sulphate of potash	4.51
Carbonate of potash	34.89
Tribasic silicate of potash	4.86
Hydrate of potash	15.10
	98.87

On calculating the hydrate of potash as the carbonate, the composition of the aqueous extract would be :—

Chloride of potassium	1.35
Potash	66.28
Phosphoric acid	12.54
Sulphuric acid	2.03
Carbonic acid	16.61
Silica	1.19
	100.00

or

Chloride of potassium	1.35
Tribasic phosphate of potash	37.29
Sulphate of potash	4.41
Carbonate of potash	52.20
Tribasic silicate of potash	4.75
	100.00

The aqueous extract of the carbonized straw did not contain any free potash. The constituents of the extract, when calculated as salts, give the following composition :—

Chloride of potassium	3.82
Chloride of sodium	9.71
Sulphate of potash	3.06
Carbonate of potash	79.53
Tribasic silicate of potash	4.46
Sulphate of lime	0.77
	101.35

Muriatic Extract.—The carbonized seeds, after exhaustion with water, did not effervesce on the

addition of muriatic acid; the straw, however, did so copiously.

The composition in 100 parts was as follows:—

	Seed.	Straw.
Potash	30.45	
Soda	4.48	
Carbonate of lime	..	63.38
Carbonate of magnesia	..	20.46
Lime	8.06	4.45
Magnesia	14.34	0.46
Peroxide of iron	1.36	2.13
Phosphoric acid	40.63	5.93
Sulphuric acid	0.32	
Silica	0.36	3.19
	100.00	100.00

The composition of the phosphates precipitated by ammonia from the muriatic solution was as follows, after having been heated to redness:— $8\,CaO+P_2O_5+2\,MgO+P_2O_5+2\,Fe_2O_3+3\,P_2O_5$. The calculated quantity of phosphoric acid in this precipitate amounts to 34.24 per cent.; analysis yielded 34.47 per cent. Thus there is an excess of 6.16 per cent. phosphoric acid.

The phosphates precipitated by ammonia from the acid extract of the straw consisted, after having been heated to redness, of 2CaO, P_2O_5+ 2MgO, $P_2O_5+Fe_2O_3$.

The Remaining Carbonaceous Mass.—The ash it contained consisted of:—

	Seed.	Straw.
Potash	21.50	
Soda	0.29	
Lime	15.19	27.53
Magnesia	14.08	13.51
Peroxide of iron	0.46	4.20
Phosphoric acid	45.79	9.29
Sulphuric acid	1.87	
Silica	0.82	45.47
	100.00	100.00

The composition of the phosphates precipitated by ammonia from the acid solution of the ash of the seeds was $2CaO, P_2O_5+2MgO, P_2O_5+Fe_2O_3, 3P_2O_5$. The phosphoric acid required by calculation is 44.17 per cent.; that found by experiment amounted to 44.10 per cent. Hence there is an excess of 1.69 per cent. phosphoric acid, which existed in the liquid filtered from the earthy phosphates. Ammonia, however, produced only a very slight precipitate in the acid solution of the ash of the carbonized straw; the fluid filtered from this still contained lime and magnesia.

The following results were obtained in the three divisions of the examination of the inorganic constituents of the rape-seed and rape-straw:—

	Seed.	Straw.
Extracted by water from the carbonized mass	9.50 p.c.	39.59 p.c.
Extracted by muriatic acid	35.60 p.c.	45.91 p.c.
In the ash of the residue	54.90 p.c.	14.50 p.c.
	100.00 p.c.	100.00 p.c.

The inorganic constituents of the rape-seed amounted to 2.48 per cent., those of the straw to 3.93 per cent.

Hence the following are the whole of the inorganic constituents of the rape-seed:—

		Oxygen.	
Chloride of potassium	0.13		
Potash	28.94	4.90	12.86
Soda	1.75	0.44	
Lime	11.19	2.33	
Magnesia	12.84	4.97	
Peroxide of iron	0.74	0.22	
Phosphoric acid	40.79	22.85	25.15
Sulphuric acid	1.34	0.80	
Carbonic acid	1.58	1.14	
Silica	0.70	0.36	
	100.00		

The amount of oxygen in the acids is twice as great as that of the bases in the rape-seed as in peas.

The rape-straw yielded the following inorganic constituents:—

		Oxygen.	
Chloride of potassium	1.48		
Chloride of sodium	3.79		
Potash	23.02	3.90	13.29
Lime	22.47	6.31	
Magnesia	6.72	2.60	
Peroxide of iron	1.57	0.48	
Phosphoric acid	4.07	2.28	27.10
Sulphuric acid	0.76	0.45	
Carbonic acid	27.51	19.90	
Silica	8.61	4.47	
	100.00		

Two anlayses were also made of rape according to the old plan, and were found to yield the same errors as those which have been previously described.

On comparing the constituents of the ash of peas with those of rape-seed, we find that the aqueous extract of the carbonized peas differs essentially from that of the carbonized rape in the large amount of alkaline chlorides which it contains, and which are present in very small quantity in the rape, whilst the latter contains more phosphate of potash than the former. The muriatic extract of the carbonized rape also contains much more phosphoric acid than that of the peas, whilst the anoxidic portion of the carbonized mass of the peas yields more phosphoric acid than that of the rape.

Appendix V.

On the amount of silica contained in some plants. By M. Struve.

As is well known, the stems of the Equisetaceæ when incinerated leave a residue consisting of almost pure silica, which retains the form of the original stem. It fuses before the blowpipe on charcoal. If this residue be exhausted, first with water and then with muriatic acid, which dissolve very small quantities of alkaline salts, among which we find phosphoric acid, together with sulphate and phosphate of lime, it no longer fuses before the blowpipe. The ash of the following species of Equisetum, after treatment with water and acids, yielded the following composition:—

	Silica.	Alumina.	Lime.	Impure manganoso-manganic oxide.
Equisetum hiemale	97.52	1.700	0.69	
Equisetum limosum	94.85	0.990	1.57	1.69
Equisetum arvense	95.43	2.556	1.64	

The epidermis of the stolones of Calamus rhodan, the Spanish cane, which may be easily separated by repeatedly bending them, consists almost entirely of silica, whilst the woody substance itself contains mere traces of it. Muriatic acid does not remove either alumina or other bases, excepting a very small quantity of lime. This silica does not fuse before the blowpipe. After treatment with muriatic acid, it had the following composition:—

Silica	99.20
Lime	0.45
	99.65

Spongia lacustris, from the neighbourhood of Berlin, also leaves an ash having the form of the plant, which, as in the preceding instances, is not destroyed after exhaustion with water and muriatic acid, which removes some lime. Its composition was then as follows:—

Silica	94.66
Alumina	1.77
Lime	2.99
	99.42

It is very probable that the substance stated to be alumina in these analyses is really phosphate of lime or magnesia. Alumina has not hitherto been detected with certainty in the ash of plants.

Appendix VI. and VII.

Examination of the ash of wheat and wheat-straw. By M. Weber.

The quantity of substance used amounted to 300 grms. in the case of the grain, and 100 grms. in that of the straw.

Aqueous Extract.—During evaporation it deposited copious films of silica. That of the grain left a residue weighing 1.413 grm., that of the straw 1.216 grm.; it had the following composition:—

	Wheat-grain.	Straw.
Chloride of potassium	..	48.09
Chloride of sodium	27.05	2.84
Potash	33.64	2.17
Soda	6.37	—
Sulphuric acid	..	2.34
Phosphoric acid	31.72	—
Silica	..	44.58
	98.78	99.92

The presence of so large a quantity of silica in the aqueous extract of the straw is very remarkable. A soluble compound of chloride of potassium and silica must be formed under certain circumstances. The films of silica deposited during evaporation were not changed by digestion with muriatic acid; nor did they exhibit any regular structure under the microscope, but consisted of pure silica.

Potash and soda exist in the aqueous extract of the carbonized wheat in combination with phosphoric acid in the form of *b*-phosphates. The amount of phosphoric acid required by calculation is 32.72 per cent.

Muriatic Extract.—The residue consisted of:—

	Wheat.	Wheat-straw.
Potash	14.40	
Soda	1.66	
Lime	4.33	46.83
Magnesia	22.35	10.56
Peroxide of iron	1.72	2.96
Phosphoric acid	54.77	33.54
Silica	0.77	6.11
	100.00	100.00

In the muriatic extract of the wheat all the bases combined with phosphoric acid are in the *b*-phosphates. The quantity of phosphoric acid corresponding to these salts amounts to 57.20 per cent.; experiment gave only 54.77 per cent.

In the muriatic extract of the carbonized straw the precipitate produced by ammonia consisted of $8CaO+3PO_5+2Fe_2\ O_3+3P_2O_5$; the phosphoric acid thus required amounts to 34.60 per cent.; analysis yielded 33.54 per cent. The liquid filtered from this precipitate still contained small quantities of the carbonates of lime and magnesia.

The Exhausted Carbonized Mass.—The composition of the ash was as follows:—

	Wheat-grain.	Straw.
Potash	22.70	
Lime	7.30	1.97
Magnesia	9.86	0.66
Peroxide of iron	1.76	1.13
Phosphoric acid	54.05	1.54
Silica	4.33	94.70
	100.00	100.00

On calculating the bases in the ash of the residuary carbonaceous mass as *b*-phosphates, there is an excess of phosphoric acid, part of which formed *a*-phosphates. The bases would require 44.19 per cent. phosphoric acid to form *b*-phosphates. The principal constituent of the ash of the straw was silica. The muriatic solution of the ash yielded with ammonia a precipitate consisting of $8CaO+3P_2\ O_5+2MgO+P_2\ O_5+Fe_2\ O_3+P_2\ O_5$. The liquid filtered from this precipitate still contained small quantities of lime and magnesia, probably more than would correspond to the solubility of the earthy phosphates in a solution of muriate of ammonia:—

The three divisions of the analysis of the grains and straw of wheat gave:—

	Grain.	Straw.
Extracted by water	36.80	31.79
Extracted by muriatic acid	43.93	13.39
Ash of the remaining carbonaceous mas	19.27	55.82
	100.00	100.00

The inorganic constituents of the grain amount to 1.28 per cent., those of the straw to 3.825 per cent.

Thus the composition of the entire ash of the grain would be :—

		Oxygen.	
Chloride of sodium	10.00		
Potash	23.18	3.83	9.30
Soda	3.09	0.76	
Lime	3.33	0.83	
Magnesia	11.75	3.54	
Peroxide of iron	1.11	0.34	
Phosphoric acid	46.36	25.97	
Silica	1.18		
	100.00		

The oxygen contained in the bases to that in the phosphoric acid is nearly in the proportion of 2 : 5. It has already been stated that the phosphates obtained in the various parts of the analysis were pyrophosphates.

The composition of the entire ash of the straw is :—

		Oxygen.	
Chloride of potassium	15.13		
Chloride of sodium..	0.89		
Potash	0.68	0.11	3.00
Lime	6.93	1.94	
Magnesia	1.69	0.65	
Peroxide of iron	0.99	0.30	
Phosphoric acid	5.05	2.82	3.28
Sulphuric acid.....	0.74	0.44	
Silica.....	67.90		
	100.00		

As we have already stated, wheat-straw belongs, apparently, to the meroxidic substances. But if we deduct the large amount of silica, which must be regarded as existing in a perfect state of oxidation in the straw, from the anoxidic substances, so very small quantity of it remains, that the wheat-straw may be regarded as an almost teleoxidic substance.

Appendix VIII.

Analysis of the ash of the blood of the ox. By M. Weber.

The entire blood was carbonized by the method stated.

Aqueous Extract.—The blood requires to be washed for nearly fourteen days to obtain a proper extract for the first portion of the analysis.

The residue of the aqueous extract consisted of :—

Chloride of sodium	59.31	Na Cl	59.31
Soda	14.67	KO, SO_3..	0.78
Potash	11.91	3KO. P_2O_5	1.58
Phosphoric acid..	0.53	KO, CO_2..	15.31
Sulphuric acid	0.36	NaO, CO_2.	19.67
Carbonic acid.....	13.01	NaO, HO.	4.05
	99.79		100.70

The small quantity of free alkali which is produced by the action of the carbon upon the alkaline carbonate, and which is considered as hydrate of soda, might perhaps be regarded more correctly as alkaline carbonate.

Muriatic Extract.—This consisted of :—

Soda	41.39
Potash	12.60
Lime	6.95
Magnesia	4.10
Peroxide of iron.....	21.60
Phosphoric acid	13.36
	100.00

The amount of alkali present is very striking, and is much too large to allow of the supposition that the alkalis combined with phosphoric acid had existed in the form of double salts with the earthy phosphates. The quantity of phosphoric acid found is exactly sufficient to form with the lime $8CaO + 3PO_5$, and with magnesia $2MgO + PO_5$. The quantity required by calculation is 13.62 per cent.; that found amounts to 13.36 per cent. Probably the alkalis existed as chlorides in the carbonized mass which had been exhausted with water, and had escaped its action. This is rendered more probable by the fact that the sum of the constituents of the muriatic extract, including the alkalis, amounted to much less than the direct weight of the evaporated residue.

Residuary Carbonaceous Mass.—It consisted of—

Potash	7.94
Soda	47.22
Lime	4.09
Magnesia	1.46
Peroxide of iron	16.69
Phosphoric acid.....	18.37
Sulphuric acid	0.61
Silica	3.62
	100.00

The amount of phosphoric acid is too small to form *c*-phosphates with the earths and alkalis, much less can the peroxide of iron be considered as combined with phosphoric acid.

The relative amounts per cent. obtained by the three operations are :—

Extracted by water	60.90
Extracted by muriatic acid	6.04
Ash of the residuary carbonaceous mass ..	33.06
	100.00

The whole analysis of the blood gave :—

		Oxygen.	
Chloride of sodium ..	36.16		
Soda	27.08	6.92	10.58
Potash.....	10.66	1.80	
Lime	1.77	0.49	
Magnesia	0.73	0.28	
Peroxide of iron	6.84	1.09	
Phosphoric acid	7.21	4.03	10.62
Sulphuric acid	0.42	0.25	
Carbonic acid	7.94	5.73	
Silica	1.19	0.61	
	100.00		

Hence the statement formerly made, that the inorganic constituents of the blood agree with those of many seeds, is only partly correct. The inorganic constituents of the wheat, excluding a considerable amount of chloride of sodium, consist almost entirely of pyrophosphates. The inorganic constituents of peas and rape, which differ in regard to the amount of alkaline chlorides they contain, nevertheless agree generally in the amount of the oxygen of all the bases being about half as great as that of the acids; whilst in the inorganic constituents of the blood the bases are combined with much smaller quantities of acids, so that the oxygen of the base is about equal to that of the acids. There is especially a much less quantity of phosphoric acid to a larger amount of peroxide of iron in the blood than in the seeds of the *Leguminosæ* or the Cerelia. At all events the blood is a meroxidic substance; and the teleoxidic portion of it is only apparently greater than the anoxidic, because the large quantity of alkaline chlorides in the former cannot be considered as forming part of the teleoxidic portion.

[*To be continued.*]

ON COLOURING MATTERS.

By Dr. EDWARD SCHUNCK.

[*Continued from page* 164.]

Of the compounds of alizarine with bases I prepared the lime, baryta, and lead compounds. The two former were prepared by dissolving alizarine in ammonia, and precipitating with chloride of calcium and chloride of barium, the latter by dissolving alizarine in alcohol and precipitating with an alcoholic solution of sugar of lead. The latter forms a purple precipitate, which, after standing for some hours, becomes of a dull red.

The lead compound gave on analysis the following numbers :—

I. 0.4800 grm. gave 0.2095 oxide of lead and 0.0245 metallic lead, equivalent to 0.2359 oxide of lead.

0.5125 grm. burnt with chromate of lead gave 0.7050 carbonic acid and 0.0780 water.

II. 0.5865 grm. of a different preparation gave 0.3970 sulphate of lead, equivalent to 0.2920 oxide of lead.

0.6915 grm. gave 0.9370 carbonic acid and 0.1005 water. Hence was deduced the following composition :—

		Calculated Numbers.	Found. I.	Found. II.
14 eqs. carbon	84	37.57	37.51	36.95
4 " hydrogen	4	1.78	1.67	1.61
3 " oxygen	24	10.75	11.70	11.65
1 " oxide of lead.	111.7	49.90	49.12	49.79
	223.7	100.00	100.00	100.00

The lime compound gave the following results :—

I. 0.4685 grm. gave 0.2065 sulphate of lime, equivalent to 0.0857 lime.

II. 0.4750 grm. gave 0.2125 sulphate of lime, equivalent to 0.0882 lime.

Assuming that the formula for this compound is $C_{14}\ H_4\ O_3 + CaO + HO$, its composition would be as follows :—

		Calculated Numbers.	Found. I.	Found. II.
1 eq. alizarine	112	74.91		
1 " water	9	6.03		
1 " lime	28.5	19.06	18.30	18.58
	149.5	100.00		

The baryta compound gave the following :—

0.2450 grm. gave 0.1420 sulphate of baryta, equivalent to 0.0932 baryta.

Assuming that the formula of this compound is similar to that of the last, viz., $C_{14}\ H_4\ O_3 + BaO + HO$, its composition would be as follows :—

		Calculated.	Found.
1 eq. alizarine....	112	56.65	
1 " water.....	9	4.57	
1 " baryta	76.68	38.78	38.03
	197.68	100.00	

Neither of these compounds loses the equivalent of water which it contains on being heated in a water-bath for several hours.

The composition of crystallized alizarine must therefore be as follows :—

		Calculated.
14 eqs. carbon	84	56.75
8 " hydrogen	8	5.40
7 " oxygen	56	37.85
	148	100.00

or,

		Calculated Numbers.	Found.* I.	Found.* II.
1 eq. dry alizarine ..	121	81.76		
3 eqs. water	27	18.24	18.33	18.32
	148	100.00		

It follows that alizarine dried at 212° must consist of :—

		Calculated.
14 eqs. carbon	84	69.42
5 " hydrogen	5	4.13
4 " oxygen	32	26.45
	121	100.00

If this be the true composition of alizarine, it follows that there exists a very singular relation between it and the composition of benzoic acid. The formula of benzoic acid is $C_{14}\ H_6\ O_4$, and alizarine only differs from it, therefore, by containing one equivalent less of hydrogen. If we compare alizarine with isatine, we shall find that the latter only differs from the former by containing in addition the elements of one equivalent of cyanogen. The formula of isatine is $C_{16}\ H_5\ NO_4 = C_{14}\ H_5\ O_4 + C_2\ N$. Anthranilic acid differs in composition from alizarine in containing in addition the elements of amidogene, for the formula of anthranilic acid is $C_{14}\ H_7\ NO_4 = C_{14}\ H_5\ O_4 + NH_2$.

Alizaric Acid.—In my former report I stated that alizarine, when treated with concentrated solutions of persalts of iron, is converted into a new acid, which I called alizaric acid. I stated at the same time that I thought it probable that alizaric acid might also be formed by acting on alizarine with nitric acid. This supposition has

* See above and page 164.

since been confirmed. On treating pure crystallized alizarine with boiling nitric acid, it is decomposed with an evolution of nitrous acid, and the liquid on evaporation gives crystals of alizaric acid. It is, however, not necessary to prepare pure alizarine in order to obtain alizaric acid. I have found the following to be the easiest method :—Nitric acid of about sp. gr. 1.20 having been put into a retort, garancine is introduced into the acid, and the liquid is heated until the red fumes have ceased to be evolved, and the colour of the garancinc has changed from dark brown to yellow. The reddish-yellow acid liquid which is obtained is filtered or strained to separate it from the woody fibre, &c., of the garancine, and evaporated to crystallization. A yellow crystalline mass is obtained, which is a mixture of oxalic acid and impure alizaric acid. After being washed with cold water to remove the excess of nitric acid, the mass is dissolved in boiling water, and chalk is added until all effervescence and acid reaction have ceased. The liquid is filtered, and the oxalate of lime remaining on the filter is washed with boiling water, until no more lime can be detected in the percolating liquid. The liquid is a solution of alizarate of lime. Muriatic acid is added to it, and it is evaporated to crystallization. A yellow mass is again obtained, which may be washed with cold water to remove the chloride of calcium, then redissolved in boiling water. It forms a yellow solution, which may be almost decolorized by animal charcoal. On again evaporating, the alizaric acid is obtained in large crystals. Should these crystals still retain a yellow tinge, which is generally the case, they must be redissolved in boiling water. By passing chlorine gas through the boiling solution, until every trace of colour has disappeared, perfectly colourless crystals of the acid are obtained on cooling. Prepared in this way, it appears in large flat rhombic plates : it has the properties which I described in my last report.

The salts of alizaric acid are mostly soluble. Alizarate of potash is formed by neutralizing a watery solution of alizaric acid with carbonate of potash : it is obtained on evaporation as a deliquescent mass. Alizarate of lime is prepared by neutralizing alizaric acid with carbonate of lime, and evaporating to crystallization. It crystallizes in prisms, possessing great lustre. Alizarate of baryta, prepared in the same way by means of carbonate of baryta, crystallizes in silky needles. Alizarate of silver, prepared by double decomposition, is soluble in boiling water, from which it crystallizes on the solution cooling. Alizarate of lead is an insoluble white powder, obtained by precipitation of the acid with sugar of lead. With ammonia alizaric acid does not seem to form a neutral salt. On supersaturating a solution of the acid with ammonia, and evaporating, the solution acquires during evaporation an acid reaction, and at length a salt crystallizes out in flat plates, which is, no doubt, a superalizarate of ammonia. All the salts of alizaric acid, when strongly heated, are decomposed with an evolution of a fragrant smell similar to that of benzine, and give, as a product of the decomposition, a thick brown oil, to which, without doubt, the smell is owing ; while the carbonates of the bases, or the bases themselves, remain behind mixed with much charcoal.

The elementary analysis of alizaric acid gave the following results:—

I. 0.5250 grm. obtained by means of perchloride of iron and burnt with oxide of copper gave 1.1015 carbonic acid and 0.1810 water.

II. 0.4670 grm. obtained by means of nitric acid and burnt with chromate of lead gave 0.9865 carbonic acid and 0.1685 water.

III. 0.4475 grm. of the same preparation as the preceding gave 0.9360 carbonic acid and 0.1625 water.

IV. 0.4395 grm. purified by means of chlorine and burnt with chromate of lead gave 0.9335 carbonic acid and 0.1510 water.

These numbers give in 100 parts :—

	I.	II.	III.	IV.
Carbon	57.20	57.61	57.10	57.92
Hydrogen ..	3.83	4.00	4.03	3.81
Oxygen ..	38.97	38.39	38.87	38.27
	100.00	100.00	100.00	100.00

Alizarate of lead was analyzed with the following results :—

I. 0.8110 grm. gave 0.2665 oxide of lead and 0.2160 metallic lead, equivalent to 0.4991 oxide of lead.

0 6660 grm. gave 0.5810 carbonic acid and 0.0915 water.

II. 0.6230 grm. gave 0.2040 oxide of lead and 0.1655 metallic lead, equivalent to 0.3822 oxide of lead.

0.6515 grm. gave 0.5560 carbonic acid and 0.0860 water. Hence was deduced the following composition:—

		Calculated Numbers.	Found. I.	Found. II.
14 eqs.	carbon	84	23.37	23.79	23.27
4 "	hydrogen ..	4	1.11	1.52	1.46
6 "	oxygen	48	13.37	13.15	13.93
2 "	oxide of lead	223.4	62.15	61.54	61.34
		359.4	100.00	100.00	100.00

The baryta salt lost nothing in weight on being heated for several hours in a water-bath.

I. 0.6725 grm. of baryta salt dried at 212° gave 0.5245 sulphate of baryta, equivalent to 0.3442 baryta.

II. 0.7330 grm. gave 0.5700 sulphate of baryta, equivalent to 0.3740 baryta.

Its composition is, therefore, probably as follows :—

		Calculated.	Found. I.	Found. II.
1 eq.	anhydrous acid	136	46.26		
1 "	water	9	2.36		
2 eqs.	baryta	153.3	51.38	51.18	51.03
		298.3	100.00		

It is probable that the silver salt also contains two equivalents of base to one of acid.

It follows from the analysis of the lead salt that the hydrated acid has the following composition :—

		Calculated.
14 eqs.	carbon	84	57.93
5 "	hydrogen	5	3.44
7 "	oxygen	56	38.63
		145	100.00

By the action of nitric acid on alizarine the latter takes up three equivalents of oxygen without losing any hydrogen, for $C_{14} H_5 O_4 + 3O = C_{14} H_5 O_7$. It appears also that alizaric acid contains one equivalent of hydrogen less, and three equivalents of oxygen more, than benzoic acid.

Pyro-alizaric Acid.—When alizaric acid is heated it is totally volatilized, and forms a sublimate in the shape of long white needles, to which I have given the name of pyro-alizaric acid. By the action of heat alizaric acid loses water, or the elements of water. Pyro-alizaric acid is soluble in boiling water. The solution, however, produces exactly the same reactions as alizaric acid itself, and on evaporation large rhombic crystals are obtained, which have quite the appearance of the latter acid. The following results were obtained on analyzing this acid :—

I. 0.4405 grm. dried at 212° and burnt with chromate of lead gave 1.0345 carbonic acid and 0.1185 water.

II. 0.4255 grm. gave 0.9985 carbonic acid and 0.1215 water.

From these numbers it may be inferred that the composition is as follows :—

			Calculated. Numbers.	Found. I.	Found. II.
28 eqs.	carbon ..	168	63.87	64.04	63.99
7 "	hydrogen	7	2.66	2.98	3.17
11 "	oxygen ..	88	33.47	32.98	32.84
		263	100.00	100.00	100.00

Hence it follows that by the action of heat two equivalents of alizaric acid lose three equivalents of water, and give one equivalent of pyro-alizaric acid, since $2(C_{14} H_5 O_7) - 3HO = C_{28} H_7 O_{11}$.

Rubiacine.—In my last report I described the method of preparation and the properties of rubiacine and rubiacic acid, and I have nothing further to add to what I there stated. I may mention, however, that I have arrived at the conclusion that rubiacine cannot be considered as a true colouring matter, as it is impossible to dye with it. I shall also show that, contrary to the opinion which I was led to entertain in the first instance, rubiacine does not contribute to produce any effect in the process of madder-dyeing.

On subjecting rubiacate of potash and rubiacic acid to analysis, I obtained the following results :—

I. 0.4490 grm. rubiacate of potash gave 0.1090 sulphate of potash, equivalent to 0.0589 potash.

0.4350 grm. gave 0.7950 carbonic acid and 0.0900 water.

II. 0.3245 grm. gave 0.0790 sulphate of potash, equivalent to 0.0427 potash.

0.2890 grm. gave 0.5315 carbonic acid and 0.0665 water.

From these numbers it may be inferred that the salt is composed as follows :—

			Calculated Numbers.	Found. I.	Found. II.
31 eqs.	carbon ..	186	51.63	51.50	51 82
7 "	hydrogen	7	1.34	2.29	2.55
15 "	oxygen ..	120	33.31	33.09	32.47
1 "	potash ..	47.27	13.12	13.12	13.16
		360.27	100.00	100.00	100.00

I. 0.3785 grm. rubiacic acid dried at 212° and burnt with oxide of copper gave 0.7940 carbonic acid and 0.0845 water.

II. 0.3605 grm. of another preparation gave 0.7610 carbonic acid and 0.0795 water.

III. 0.4670 grm. of the same preparation as the preceding gave 0.9775 carbonic acid and 0.1050 water.

Hence was deduced the following composition :—

			Calculated Numbers.	Found. I.	Found. II.	Found. II.
31 eqs.	carbon ..	186	57.76	57.21	57.57	57.08
8 "	hydrogen .	8	2.48	2.48	2.45	2.49
16 "	oxygen ..	128	39.76	40.31	39.98	40.43
		322	100.00	100.00	100.00	100.00

0.3150 grm. rubiacine dried at 212° and burnt with oxide of copper gave 0.7740 carbonic acid and 0.0935 water.

This gives the following composition :—

			Calculated.	Found.
31 eqs.	carbon	186	67.63	67.01
9 "	hydrogen	9	3.27	3.28
10 "	oxygen	80	29.10	29.71
		275	100.00	100.00

The formula of rubiacine being $C_{31} H_9 O_{10}$, and that of rubiacic acid $C_{31} H_8 O_{16}$, it follows that when rubiacine is converted into rubiacic acid it loses one equivalent of hydrogen and takes up six equivalents of oxygen, and that when rubiacic acid is reconverted into rubiacine it loses six equivalents of oxygen and takes up again one of hydrogen. This oxidation and reduction are accomplished with the same certainty and precision as any similar process with inorganic bodies.

Alpha-Resin.—This resin is a constituent of the dark brown precipitate produced by acids in a decoction of madder. It dissolves together with rubiacine, when this precipitate is treated with a boiling solution of perchloride or pernitrate of iron, and is precipitated together with rubiacine and rubiacic acid when muriatic acid is added to the solution. It is separated from the rubiacine and rubiacic acid by means of alcohol, in which it is easily soluble, while the two former are but little soluble. It has a dark brown or reddish-brown colour. When cold it is brittle, and may be easily pulverized. It begins to become soft at

150° F., and melts to dark brown drops between 200° and 212°. When heated on platinum-foil it melts, swells up, and burns with flame, leaving much charcoal, which, however, burns away without leaving any residue. When heated in a glass tube it swells up, gives an oily sublimate, and evolves a strong smell, leaving at last a bulky carbonaceous residue. It is slightly soluble in boiling water, to which it communicates a yellow tinge. On the solution cooling yellow flocks are deposited, which are increased in quantity by adding an acid. It dissolves in alcohol with an orange colour; water makes the solution milky, and on the addition of an acid the resin is completely precipitated in orange-coloured flocks. The alcoholic solution does not redden litmus paper. It dissolves in concentrated sulphuric acid with a dark orange colour, and is reprecipitated by water in yellow flocks. It is decomposed by boiling concentrated nitric acid; on evaporating the acid a resinous mass is left. It dissolves in caustic and carbonated alkalis with a purplish-red colour. The solution in ammonia does not lose its ammonia on boiling, but on evaporation the resin is left in combination with a little ammonia. The ammoniacal solution gives purple precipitates with the chlorides of barium and calcium, and a dirty red precipitate with alum. It dissolves in perchloride and pernitrate of iron with a dark reddish-brown colour, and is reprecipitated by acids in flocks. The alcoholic solution gives red precipitates with alcoholic solutions of sugar of lead and acetate of copper. If chlorine be passed through a solution of the resin in caustic potash it is decolorized; acids, however, now produce no precipitate, so that the resin seems to have been entirely decomposed by the chlorine. If mordanted cloth be introduced into boiling water, in which a quantity of the resin is suspended, the alumina mordant acquires an orange colour, and the iron mordant a brown colour. Nevertheless these colours are so slight that it is not likely that this resin contributes in any way to produce the desired effect in the process of madder-dyeing. I shall presently show that, on the contrary, it is rather injurious than otherwise in this process, since those parts of the cloth which should remain white acquire from it a disagreeable yellow tinge, which cannot afterwards be removed by merely washing with water, so that, even if it did contribute to produce any greater intensity of colour on the mordanted parts, the advantage would be more than counterbalanced by the injurious effect on the unmordanted parts.

Beta-Resin.—This resin also forms a constituent of the dark brown precipitate produced by acids in a decoction of madder. If this precipitate be treated with a boiling solution of perchloride or pernitrate of iron, the beta-resin forms a compound with peroxide of iron, which remains undissolved. By decomposing this compound with muriatic acid, and dissolving the resin in boiling alcohol, it is deposited on the alcohol cooling as a light brown powder. It hardly melts at the temperature of boiling water, but merely becomes soft and coheres into lumps. When heated on platinum foil, it melts and burns, leaving a slight red ash. When heated in a glass tube, it gives yellow fumes and evolves a disagreeable smell, leaving a carbonaceous residue. It is slightly soluble in boiling water, to which it communicates a yellow tinge; on the solution cooling nothing separates, but on adding acid some yellow flocks are deposited, while the liquid becomes colourless. The alcoholic solution is dark yellow; it reddens litmus-paper. Water renders it milky, and acids precipitate the resin completely in yellow flocks. The resin dissolves in concentrated sulphuric acid with a dark brown colour, and is reprecipitated by water in light brown flocks. Concentrated nitric acid dissolves it on boiling and decomposes it; on evaporation there is left a yellow, bitter astringent substance. It dissolves in caustic and carbonated alkalis with a dirty red colour, inclining to purple in the case of caustic alkali. It is reprecipitated by acids in brown flocks. If chlorine be passed through a solution of the resin in caustic potash, it is decolorized; but the substance itself seems to be thereby decomposed, as acids afterwards produce only a slight precipitate. The ammoniacal solution gives with the chlorides of barium and calcium dirty yellow precipitates. The alcoholic solution gives with an alcoholic solution of sugar of lead a red precipitate, and with an alcoholic solution of acetate of copper a brown precipitate. The ammoniacal solution loses its ammonia on evaporation, and the resin is left as a transparent brown skin. This resin has the same effect on mordanted cloth as the preceding; the alumina mordant acquires an orange and the iron mordant a brown colour, while the unmordanted parts become yellow and unsightly. These effects are not, however, so decided as in the case of the alpha-resin, which is probably owing to its being less soluble in water than the latter.

Rubian.—I have given this name to the substance to which the bitter taste of madder seems to be due. I have described its method of preparation and properties in my last report. I may state, in addition to what I there said, that rubian seems to be a nitrogenous body, since, on treating it with boiling caustic alkali, ammonia is evolved. This fact and the bitter taste seem to indicate that the medical properties of madder, if indeed it possesses any, reside in this substance.

If a solution of rubian in water be evaporated in contact with the air and with the assistance of heat, it deposits a dark brown substance, which sinks to the bottom in resinous drops, so that, on treating the residue after evaporation with water, it is not completely redissolved; and, if the filtered liquid be again evaporated as before, a fresh quantity of the dark brown substance is formed, just as in the case of extractive matter. This dark brown substance melts into drops in boiling water, but when cold it is brittle. It dissolves in alkalis with a dark red colour, and is reprecipitated by acids in yellow flocks; indeed it bears in all respects a great resemblance to the body which I have called alpha-resin. Nevertheless it seems to consist of more than one substance, for, if it be heated in a glass tube over a lamp, an abundant sublimate, consisting of shining yellow crystals, is obtained in the upper part of the tube: these crystals very much resemble rubiacine. If it be treated with a boiling solution of perchloride or pernitrate of iron, the liquid becomes reddish-brown, and gives after filtration a yellow precipitate with muriatic acid, which is a proof of its containing either alpha-resin or rubiacine, or both. Hence it becomes very probable that rubiacine, the alpha-resin, and perhaps also the beta-resin, are formed from rubian by the action of the oxygen of the air. It becomes still more probable when we consider the following facts:—If an infusion of madder with cold water be allowed to stand in contact with the air, it will be found that after some hours the liquid is filled with a number of long hair-like crystals, which are, as I have shown on a previous occasion,* rubiacine, generally mixed with a substance having all the properties of beta-resin. I have had one specimen of madder which gave such quantities of rubiacine on allowing the infusion to stand that it collected on the surface of the liquor as a bright yellow scum, and by crystallizing it from alcohol it was obtained almost in a state of purity. Now, as rubiacine is insoluble in cold water, it must in this case either have been formed from some substance contained in the infusion by the action of the air, or else it was at first held in solution by some other substance, such as an alkali or alkaline earth, from which it gradually became separated, as by the formation of some acid in the liquid. I incline to the former supposition, and think it probable that it is the rubian which by its oxidation gives rise to the rubiacine.

Xanthine.—This substance, the method of preparing which from a decoction of madder after the separation of the colouring matters, &c., by acid, I have described above, is, of course, not a pure substance, since after ignition it leaves a considerable quantity of fixed residue; it is also probable that it contains a small quantity of sugar, as I stated before. Nevertheless it produces reactions of a peculiar kind, which cannot be attributed to sugar, gum, or any similar substance, and can only be due to a peculiar body which exists only in madder. It has the following properties:—When prepared as above described it is a thick, viscid, yellow, or brownish-yellow syrup, resembling honey in colour and consistency, which cannot be rendered dry even by exposing it to a heat at which it begins to be decomposed. When exposed to the air it becomes more liquid on account of its attracting moisture. When heated to ignition it swells up enormously, giving off at the same time a very perceptible smell of aceton, and burns, leaving at last a considerable quantity of ash, which consists of the carbonates of lime, magnesia, and potash. It is without doubt the acetates of those bases which, being mixed with the substance, produce the smell of aceton during ignition. The acetic acid was of course derived from the basic acetate of lead used in the preparation of xanthine, and the acid with which they were originally combined must have gone to the oxide of lead. Now, as I stated above, the oxide of lead was found to be combined with phosphoric acid; hence it is probable that the greater part, if not all, of the fixed bases left after the ignition of the xanthine existed in the plant as phosphates. Xanthine has a disagreeable taste, between bitter and sweet. The watery solution is yellow. It is soluble in alcohol, and is left after evaporation in the same state as before. It is insoluble in ether. On adding muriatic or sulphuric acid to the watery solution, and boiling for some time, a peculiar smell is evolved, the solution becomes gradually dark green, and a dark green powder is deposited. This is the most characteristic property of xanthine. Nitric acid does not produce the same dark green powder, or any deposit on boiling; nevertheless the powder which has once been formed by means of muriatic or sulphuric acid is not dissolved by boiling nitric acid, but only turned yellow. Acetic acid produces no effect. Oxalic acid gives a white precipitate of oxalate of lime. Bichromate of potash and sulphuric acid produce no effect on a solution of xanthine, even on boiling. On adding caustic potash to the solution it turns brown, and on boiling a slight smell of ammonia is evolved. Lime and baryta-water, acetate and basic acetate of lead, the acetates of alumina, iron, and copper, nitrate of silver, corrosive sublimate, and a solution of glue, produce no precipitate or effect whatever in a solution of xanthine. In fact it does not seem to be precipitated by any reagent whatever without undergoing decomposition.

If a clear light yellow watery solution of xanthine be evaporated with the assistance of heat and in contact with the air, as on the sand-bath, to a syrup, and this syrup be again mixed with water and the solution again evaporated, the process being several times repeated, the solution gradually becomes dark brown, and at length a dark brown powder is deposited. The brown solution now gives with acetate or basic acetate of lead a thick brown precipitate. The filtered liquid is yellow, and, if the excess of lead be removed by sulphuretted hydrogen, the solution again gives, on evaporation over sulphuric acid, a colourless or light yellow syrup, which, however, if redissolved and evaporated with the assistance of heat as before, again becomes dark brown, and deposits a dark brown powder. There can, therefore, be no doubt that this brown powder is a product of the oxidation of xanthine, that xanthine is a species of extractive matter, and that the brown powder stands in the relation to it of an apothema. This brown powder has the following properties:—When dry it is a dark brown mass, easily reduced to powder. It is quite insoluble in boiling water and boiling alcohol. It burns without flame, leaving much ash. It is soluble in concentrated sul-

* See the Report of the British Association for the Advancement of Science for 1846.

phurie acid with a dark brown colour, and is reprecipitated by water. Boiling dilute nitrie aeid decomposes it with an evolution of nitrous aeid, and changes it into a yellowish-red floceulent substance. Concentrated nitrie acid on boiling decomposes and dissolves it entirely. It dissolves in caustic and carbonated alkalis with a dark brown colour, and is reprecipitated by aeids in light brown flocks. The ammoniacal solution gives brown preeipitates with the ehlorides of barium and calcium. The dark green powder which is produeed by the action of sulphuric and muriatie acid on xanthine has the following properties:—

When dry it has a dark olive colour. It burns with a flame and a smell like burning wood, leaving a large quantity of charcoal, whieh, however, burns away without any fixed residue. It is decomposed by boiling dilute nitrie aeid, and changed into a yellow floceulent substance. It is insoluble in eoneentrated sulphurie aeid, and also in boiling alcohol. When treated with caustie potash a part dissolves with a dark brown eolour, and is reprecipitated by aeids as a dark brown powder, while the other part remains undissolved as a blaek powder.

Mordanted cloth acquires no eolour in a boiling solution of xanthine, if the latter is in its yellow unoxidized state; but, if the solution has beeome brown by eontaet with the air, then both the alumina and the iron mordant aequire in the boiling solution a brown eolour, while the unmordanted parts, which should remain white, become of a brown tint. Henee it follows that xanthine is injurious in madder-dyeing, and must contribute, together with the two resins, in impairing the purity of the colours, and sullying the whiteness of those parts which should attraet no colour. To get rid of the xanthine is one object of changing madder into garancine.

[*To be continued.*]

ON THE PRODUCTS OF OXIDATION OF THE VOLATILE DISTILLATES OF THE FATS.

By F. C. SCHNEIDER.

At present we are acquainted with several modes in which the volatile fatty acids are produced. They are formed by the saponification of fats, by putrefaction, distillation, and oxidation of more highly compound fatty acids, especially from oleie acid, hydrocarbons, and proteine compounds. In all these modes of formation a very complex atom is deeomposed into a simpler one, generally with the simultaneous assimilation of oxygen. Oleic acid behaves in this respect very characteristically. If oxygen is conveyed to it by means of nitric acid, a whole series of volatile fatty acids is produced; if it be submitted to destructive distillation, it furnishes principally hydroearbons, along with small quantities of fatty aeids. The author put the question whether the hydroearbons separated in this operation, consequently after they had been eliminated from the composition of oleic acid, might still be converted into the same volatile acids by oxidizing agents.

The result of this investigation is, that these hydrocarbons can certainly be converted into fatty acids by oxidizing agents, such as the alkalis, nitric and chromic acid; but all the oxidizing agents have not an equally favourable action. Nitric acid is the best, which furnishes the greater number of the volatile acids, from acetic acid to eaprylic aeid inclusively. The reason of this is owing to the circumstance, that this acid produces at the same time a nitrocompound, which consists of a mixture of hyponitric aeid and a volatile oil with a greater amount of oxygen than is contained in the original hydroearbon and of fatty acids. This compound prevents the higher fatty acids which principally occur in it, for instance, the caprylic aeid, which could only be deteeted in the nitrosubstance, from further oxidation. Chromic acid, on the contrary, furnishes only the volatile acids of the most simple constitution; because, in the absenee of a similar collateral product whieh might resist its ulterior action, the more eomplex aeids are further decomposed.

Among the products of distillation of the fatty oils, and of those fatty acids whieh are either not volatile, like the oleic and stearie acids, or whose point of deeomposition is situated very near their boiling-point, other aeids, and also acroleine, occur with the hydrocarbons. The hydrocarbons must, therefore, be first freed from the latter substances; for whieh purpose the retort is connected with several of Wolf's bottles, in which the less volatile products of distillation separate from those which are more readily volatile.

The hydroearbons which served for this investigation were prepared by distilling rape oil; they were then left for a long time in eontact with oxide of silver, to remove the acroleine and the aeids contained in them, then distilled with water, and lastly rectified alone. The liquid thus obtained, dried over ehloride of calcium, is a mixture of hydrocarbons in which carbon and hydrogen are eontained in the atomic proportion of $C_6 : H_5$. It is colourless and of a penetrating odour, resembling aeroleine. In the air, and after long standing even in elosed vessels, it becomes yellow. It has no action upon vegetable colours; but when dissolved in alcohol it reddens after a time blue litmus paper which has been moistened with it. The boiling point rises uninterruptedly from 162° to 347°. Analysis gave:—

Carbon.....	86.19	86.39	86.17
Hydrogen.....	12.15	11.96	11.97
Oxygen.....	1.66	1.65	1.86

The vapours of these hydrocarbons distil over moderately-heated soda-lime with scarcely any alteration; but if the temperature is higher the soda-lime is coloured brown by separated carbon, the disagreeable odour of the hydroearbons is converted into one whieh is less so, and very little passes over unaltered. On deeomposing the soda-lime with sulphuric acid, carbonic acid is disengaged in both cases, and in the residual liquid butyric and valerianic aeids are deteeted.

Treatment of the Hydrocarbons with Nitric Acid. The mixture of hydroearbons was treated with nitric aeid in a retort, the neck of which had an upward direetion, which was lengthened by an aecurately-fitting well-eooled glass tube, in order that the ascending vapours might be condensed and flow back. As soon as small quantities of the hydroearbons come in eontact with concentrated nitrie aeid the mass becomes heated, red vapours of nitrous acid are given off, and a cinnamon-like odour, as well as one of prussic acid and oil of bitter almonds, is perceptible; the liquid is dark-eoloured, and a resinous viseid mass separates on the sides of the vessel. When the oxidation is continued by fresh additions of nitric acid this resinous mass gradually disappears, and the contents of the retort become homogeneous. As soon as the nitric aeid has no further aetion even at a boiling temperature the oxidation is complete, the evolution of red vapours eeases, and the liquid assumes a lighter colour; after long standing, especially in the cold, the liquid separates into two layers, the upper one of which is oily and of a dark eolour, the lower one aqueous and lighter. Upon the addition of water a brownish-red mass, I., of oily consistence, strong smell of oil of bitter almonds, and aeid reaetion, separates, after long standing, at the bottom of the vessel. The turbid aqueous liquid, II., deeanted from it, smelt of valerianic and butyric acids.

This aqueous liquid, II., was saturated with earbonate of potash and evaporated. The crystals of nitre were separated from the mother ley, and the latter decomposed with sulphuric acid, when an acid layer of fat separated on the surface. This layer of oil was separated from the liquid, saturated with barytic water, boiled, filtered boiling hot, the excess of baryta in the filtered solution preeipitated by carbonie aeid, again boiled, filtered, and the solution evaporated to crystallization. The crystals were acetate of soda. They were separated from the mother ley, again dissolved, and their solution, as well as the mother ley, eaeh separately precipitated with nitrate of silver, in order to examine the silver salts of the acids present. The liquid separated from the layer of oil was distilled with water, until what passed over no longer exhibited any acid reaetion; it was then saturated with soda, and evaporated to crystallization. The crystals obtained were acetate of soda.

The barytie salts of the aqueous liquid, II., from whieh the exeess of baryta had been removed by carbonie acid, are still contaminated with a substance containing hyponitric aeid, the ehief amount of which is contained in the heavy oily mass, I., separated by water. Their solution is eoloured yellow by it. On further treatment they were separated into the following salts:—

Œnanthylate of Baryta.—The solution deposits after evaporation yellow laminar crystals, whieh are obtained pure by repeated crystallization from the boiling-hot solution. On boiling, a resinous viseid mass separates, which is very insoluble in water. The purified crystals furnished on analysis:—

	Found.			Calculated.
Atomic weight	195.30	194.30	194.50	197.64
Per centage of baryta.....	39.24	39.43	39.38	38.78

Caproate of Baryta.—The mother ley from the preceding crystals furnished on further evaporation warty groups of yellow needles, which were purified in the same manner as the œnanthylate of baryta. Analysis furnished:—

	Found.			Calculated.
Atomic weight	183.30	183.30	184.00	183.60
Per eentage of baryta.....	41.80	41.82	41.53	41.73

Valerianate of Baryta.—The very thick mother ley from the preeeding salt deposited, after long standing, some shining laminæ, which, purified as above, consisted of valerianate of baryta. Analysis gave:—

	Found.	Calculated.
Atomic weight	171.00	169.64
Per centage of baryta	44.68	45.18

The remainder of the liquid does not crystallize, but dries to a gummy mass. It contains the lower fatty aeids. A few granules of butyrate of baryta were perceptible in it. A more complete separation of the saline mass can be attained with nitrate of silver.

The separation of these salts of baryta is likewise rendered very difficult by the substance containing hyponitric acid, which is equally combined with baryta, as it separates in the resinous tenaeious state partly on the surfaee, partly on the sides of the vessel. The films which form on the surface must be removed and repeatedly exhausted with boiling water, when the mixture is decomposed, and furnishes a considerable quantity of fatty acids.

The silver salts of the aqueous liquid II., which were obtained after the separation of the acetate of soda by crystallization from the solution and the separated mother ley, were found to consist of—

Acetate of Silver.—The silver salt prepared from the crystallized soda salt, whieh was instantly recognised to be acetate, possessed all the properties of the acetate of silver:—

	Found.		Calculated.
Atomic weight	166.70	167.00	167.00
Per centage of silver	69.58	69.45	69.46

Valerianate of silver separated on the cooling of the hot solution of the silver salt obtained from the mother ley in white laminæ, which became black by exposure to the light. When purified it furnished:—

	Found.	Calculated.
Atomic weight.....	207.00	209.00
Per centage of silver..	56.29	55.50

Butyrate of silver, crystallized from the liquid, separated from the preceding salt, on further

evaporation and cooling, in dendritic crystals. It gave:—

	Found.			Calculated.
Atomic weight	196.00	194.00	194.60	195.00
Per centage of silver	59.11	59.70	59.31	59.48

Metacctonate of Silver separated on further evaporating the remaining liquid in minute hard granules, which became black on boiling, and melted quietly when heated; and, indeed, exhibited all the properties of the metacetonate of silver. A determination of the atomic weight furnished:—

	Found.		Calculated.
Atomic weight	180.80	181.00	181.00
Per centage of silver	64.16	64.07	64.09

An elementary analysis was made of the same salt, the results of which fully confirmed the above:—

Carbon	19.73	6 = 36	19.89
Hydrogen	2.67	5 = 5	2.76
Oxygen	13.64	3 = 24	13.26
Oxide of silver	64.16	1 = 116	64.09
	100.00	181	100.00

Metacctonacetate of Silver.—As soon as no more crystals of the metacetonate of silver separated, the mother ley was further evaporated, when some shining dendritic crystals were obtained, which on ignition left a delicate network of metallic silver. A determination of the atomic weight gave:—

	Found.			Calculated.
Atomic weight	173.00	174.00	174.00	174.00
Per centage of oxide of silver	66.74	66.55	66.45	66.59

Elementary analysis furnished:—

Carbon	16.80	5 = 30	17.24
Hydrogen	2.41	4 = 4	2.29
Oxygen	14.13	3 = 24	13.88
Oxide of silver	66.66	1 = 116	66.59
	100.00	174	

In the residual mother ley acetate of silver could be detected.

The nitrogenous compound, or the above-mentioned substance I. containing hyponitric acid, in the state in which it is precipitated by water, is oily, of a brownish-red colour, heavier than water, and has an acid reaction. When heated it gives off red vapours at a temperature a little above that of boiling water, and becomes black by partial decomposition and separation of carbon. Fatty acids may be extracted from the blackened mass by means of potash. When the nitrogenous compound is distilled quickly after the addition of water, fatty acids are likewise obtained; but at the same time a portion of the oil is carried over into the receiver. It combines with bases, but does not furnish very characteristic salts; with potash it gives an uncrystallizable compound of a dark brown colour; with baryta, a mass which cakes together; with oxide of silver, a fawn-coloured precipitate. When melted with hydrate of potash the mass becomes brown, ammonia escapes, and the potash combines with fatty acids. Upon the addition of sulphuric acid, prussic acid is disengaged; and on distilling the liquid a mixture of œnanthylic, caproic, and valerianic acids is obtained, which are separated by forming their baryta salts.

The decomposition of the nitrogenous compound is best effected by passing into it a current of dry ammoniacal gas. A bright red liquid is formed, from which a heavy layer of oil subsides, which is neutral and not volatile, and most closely resembles in odour and colour the hydruret of benzoyle. It does not, however, furnish any benzoate of potash when mixed with an alcoholic solution of potash, but remains dissolved in it, and can again be precipitated by the addition of water. When the mixture is distilled, the alcohol passes over with an oil which has but a faint odour of oil of bitter almonds. This oil is scarcely soluble in water, and sinks in it. When rectified an oily substance is again obtained, but some carbon is left in the retort; this separation of carbon takes place even after a second and third rectification. The rectified oil, on the other hand, has absorbed hydrogen and oxygen in the proportion to form water, as was ascertained by the elementary analysis of the two oils. When the alcohol is removed more of the oily substance is obtained; and it can be entirely separated from the potash by continued distillation with water. The oil was deprived of water by distillation over caustic lime. If, after removing the oil, the potash solution is decomposed with sulphuric acid and the mixture distilled, an acid liquid of a most disagreeable odour is obtained, which on saturation with barytic-water furnished so small a quantity of salt that the acid which it contained could not be determined.

The ammoniacal ley separated from the oily substance just described furnishes a copious precipitate with nitrate of silver after expelling the excess of ammonia. The greater portion of it dissolved in boiling water without becoming black, and again separated on cooling in white flakes. The portion which was not dissolved by the water dissolved in boiling alcohol, from which, on cooling and evaporating the alcohol, it separated as a white powder. It is caprylate of silver. The silver salt which separated from the aqueous solution was œnanthylate of silver. The succeeding crop of crystals proved to be a double compound of caproate and œnanthylate of silver.

Lastly, the mother ley, when it appeared to be of constant composition, still contained silver salts of the next following lower fatty acids down to metacetonic acid.

The results which followed from the investigation of the products of oxidation of the more volatile hydrocarbons were again obtained in the examination of the same products from the less volatile hydrocarbons; but in the latter case the nitrogenous compound had the consistence of a salve; and the separation of the salts of baryta was rendered more difficult by the admixture of a larger amount of the resinous substance.

Treatment of the Hydrocarbons with Chromic Acid.—A mixture of bichromate of potash and sulphuric acid has a very feeble action upon the hydrocarbons at the ordinary temperature. On the application of heat, a very violent reaction occurs, and the greater part of the hydrocarbons distil over, which renders the operation very tedious. When all reaction has ceased, the mixture is distilled, the product saturated with soda, precipitated with nitrate of silver, and the silver salts separated. Only metacetonic and acetic acids could be detected; the latter in greatest abundance.—*Licbig's Annalen*, lxx., p. 107, and *Chem. Gazette.*

OBSERVATIONS ON BANCA TIN, AND ON THE ATOMIC WEIGHT OF TIN.

By Prof. MULDER.

The author obtained from the Netherlands Society of Commerce samples of Banca tin, to be examined for the Government. The object was to obtain from the tin procured from the Banca tin ore a pure tin with the exception of a little iron. The examination of twenty kinds of Banca tin from different mines, and which were imported in different ships, showed them to consist of almost chemically pure tin.

From each of the twenty samples a piece was cut out of the centre, oxidized with nitric acid, and diluted with not too much water before filtration. The loss resulting from the trifling solubility of the tin in the acid liquid was neglected as too unimportant; it contained, besides mere traces of iron, lead and copper, but no silver, antimony, or arsenic. The insoluble oxide of tin was calcined and weighed. The results of the analyses are contained in the following table. I. is the kind of tin distinguished by the name of the vessel in which it was brought; II. the quantity of tin employed for examination; III. the amount of oxide of tin obtained from it after oxidation with nitric acid; and IV. the amount of pure tin, calculated upon the supposition that the oxide of tin contains in 100 parts

78.616 tin and 21.384 oxygen.

	I.	II.	III.	IV.
1.	Jacob Cats	8.597	10.9335	99.99
2.	Elise	8.841	11.2630	100.15
3.	Prins Hendrik	9.975	12.7130	100.19
4.	Zecland	11.181	14.2720	100.35
5.	Cornelia	9.082	11.5500	100.00
6.	Lucipara	12.009	15.2750	100.00
7.	Prins Frederik	12.706	16.1620	99.99
8.	Middleburg	13.443	17.0860	99.92
9.	Clara Henriette	9.609	12.2080	99.88
10.	Oud Alblas	8.764	11.1520	100.04
11.	Doggersbank	10.080	12.8160	99.95
12.	Stad Amsterdam	9.196	11.6920	99.95
13.	Koningin der Nederlanden	10.174	12.9270	99.88
14.	Zeemanshoop	12.185	15.4790	99.87
15.	Anna en Elise	9.304	11.8300	99.96
16.	Josephina en Catharina	9.253	11.7590	99.91
17.	Flora	8.090	10.2910	100.00
18.	Christophorus Columbus	10.518	13.3790	100.00
19.	Adm. Jan. Evertse	10.349	13.1660	100.01
20.	Doctrina et Amicita	8.521	10.8300	99.92
		201.877	256.7735	1999.96

From the fourth column we obtain the arithmetical mean 1999.96 : 20 = 99.998; according to which, therefore, all these samples, considering the small differences of the numbers from each other, may be regarded as almost chemically pure tin, especially if we bear in mind that a little tin was left in the nitric acid solution. This solution from all the samples, when mixed, deposited, on evaporation nearly to dryness, 0.210 oxide of tin, and about 0.0061 grm. oxide of tin was separated from the residue from the other metals. Now, since the sum of the tin taken for the twenty analyses amounted to 201.877 grms. (see column II.), and the amount of oxide of tin obtained therefrom was 256.7735 grms. (see column III.), we find, on adding to the last number the amount of oxide of tin subsequently obtained, that

201.877 grms. tin give 256.9896 grms. oxide of tin.

In the residue from which the last quantity of oxide of tin had been separated there was found an amount of oxide of iron corresponding to 0.0395 grm. iron. The oxide of lead contained in it corresponded to 0.0257 lead; the amount of oxide of copper to 0.0126 grm. copper. Not a trace of any other metal could be found in the nitric solution, not even on testing it for the presence of arsenic and antimony in Marsh's apparatus. According to the above, Banca tin has the following composition:—

Iron	0.0395	0.019
Lead	0.0257	0.014
Copper	0.0126	0.006
Tin	201.7992	99.961
	201.8770	100.000

From the excesses obtained (see column IV.) we are justified in assuming that the atomic weight of tin requires to be somewhat modified. With respect to the facts ascertained by experiment, there were obtained from 201.8770 Banca tin, which contains 201.7992 pure tin, 256.9896 oxide of tin after separation of the foreign metals; consequently 201.7992 pure tin have absorbed 256.9896—201.7992 = 55.1904 oxygen. If we calculate from this the composition of the oxide of tin for 100 parts, we find for 78.524 tin 21.476 oxygen; which would give 731.230 for the atomic weight of tin, whilst Berzelius made it 735.296.

The results above given had another object than to ascertain the composition of the Banca tin, and are, consequently, not suited, especially on account of the numerous weighings, to establish the atomic weight of tin; but, since they indicated that the equivalent of tin was too high, some experiments were made with chemically pure tin, with this especial object in

view, by Mulder and Vlaanderen. 100 parts of tin furnished :—

	Mulder.	Vlaanderen.	
		a.	*b.*
Oxide of tin	127.56	127.56	127.43

Vlaanderen, moreover, examined three other kinds of Banca tin, which contained about the same amount of foreign metals as the preceding kinds. Three oxidations of the first kind furnished for 100 parts of Banca tin 127.750, 127.707, 127.701 oxide of tin ; 100 parts of the second kind furnished 127.50, and 100 parts of the third kind 127.69 oxide of tin. These numbers differ very slightly ; and, from the coincidence of the two analyses designated by *a.* by Mulder aud Vlaanderen, these would appear to be most trustworthy, and the atomic weight of tin would be 725.7. As, however, the analysis cannot guarantee the value of 0.7, Mulder proposes, in order to obtain a whole number, to adopt 725, that is 58×12.5, as the atomic weight of tin. The analysis *b.* of Vlaanderen furnished the number 729.2, consequently nearly the same atomic weight as resulted from the above twenty experiments together (731.230). Admitting the equivalent 725, the composition of the oxide of tin in 100 parts would be :—

Tin 78.38
Oxygen 21.62

—*Scheik. Onderzoek.*, Part V., No. 4, p. 250.

ON SENNA LEAVES.
By F. L. BLEY and E. DIESEL.

Messrs. Bley and Diesel have submitted Senna obovata, S. Alexandrina, and S. Tinnevelly to chemical examination, and obtained the following results :—Volatile oil and malic acid could not be discovered in the senna. The leaves of Cassia lanceolata and of C. obovata left eleven or twelve per cent. of alkaline ashes, in which chloride of potassium, traces of lime, magnesia, and soda, were found mostly combined with carbonic acid, and also phosphoric and silicic acids. Senna leaves also contain a peculiar yellow resin, probably the same which Feneulle obtained in the impure state from senna pods. Messrs. Bley and Diesel call it Chrysoretin. The brown resin and the brown extractive matter, which was called by Lassaigne and Feneulle Cathartin, cannot be completely separated from each other. Pectin, gummy extractive matter, chlorophylle, and a small quantity of fat, were also found.

Although the authors were not able to isolate the active principle, yet they are of opinion that Alexandrian senna is more active than either the obovate or Tinnevelly senna, because it yields a larger quantity of a spirituous extract, having a superior odour and taste. This property is used as a measure, for spirit of wine also dissolves almost all the constituents which water takes up from the leaves. At the same time, it is observed as a striking circumstance that the alcoholic extract of half an ounce of senna (which had been perfectly exhausted by spirit of wine) produced only nausea and uneasiness, and could, therefore, contain but little of the active principle. As regards experiments concerning the efficacy of the individual constituents of senna, we have the following results :—The chrysoretin, in doses of from thirty to forty-five grains, remained without effect; the brown resin, in doses of from fifteen to eighty grains, did not operate upon the bowels, but merely caused nausea, and, in larger doses, vomiting. In large doses of sixty grains it appeared to operate as a diuretic, and could be detected after a short time in the urine, in consequence of the colour which it assumes on the addition of potash. The so-called cathartin, in doses of two and a half to three drachms, caused only nausea and disagreeable eructation, without operating upon the bowels.

These experiments tend to show that the individual constituents extracted by spirit of wine from the senna leaves, as well as their aggregate, do not purge. The authors, however, doubt the statement of Hecrlein, that spirit of wine only extracts from the leaves macerated in it inert substances, and none of the active principle. The final result to which they are led by their examinations is, that odour, taste, relation to chemical agents, and medicinal powers of senna depend chiefly on the co-operation of the extractive matter and the resin, and only in a subordinate degree on the pectin, the pectates, and the other salts of the leaves. No share in the activity can be ascribed to the volatile oil, as no appreciable quantity of it can be procured.—*Pharmaceut. Central Blatt*, für 1849, No. 8.

ON COLLODIUM CANTHARIDALE.
By F. ILISCH.

According to Dr. Ilisch, of St. Petersburg, collodion (or collodium), in combination with cantharidin, is in many cases well adapted to act as a vesicant, supplying not only the place of the emplastrum cantharidis, but affording even the advantage of dispensing with linen and leather. It is particularly useful in cases where a strong vesicant is to be applied to a part of the body where it can be easily disturbed by the movements of the patient, or where the irritability of the latter prevents the undisturbed position of the plaster.

For its application nothing is required but to paint the part with it by means of a brush. If, after the collodium has been thus applied and dried, which occurs within about half a minute, some part of the skin is found not to be perfectly covered by it, the application is to be repeated ; and the effect is quicker and safer if the part be covered with lard or melilot plaster. The collodion operates as speedily as blister-plaster, and possesses the advantage of not staining the linen.

Preparation.—One pound of coarsely-powdered cantharides is subjected to the action of one pound of sulphuric ether and three ounces of acetic ether, in Mohr's apparatus ; and the liquid is allowed to percolate the cantharides as long as it is coloured, by which a saturated ethereal solution of cantharides, together with some coloured animal fat, is obtained. In two ounces of this liquid twenty-five grains of gun-cotton are dissolved. This is the easiest method, and can be performed with facility in the laboratory of any apothecary. The process is more complicated and expensive if twenty grains of pure cantharidin and twenty-five grains of gun-cotton be dissolved in one ounce and a half of sulphuric ether and half an ounce of acetic ether.

The collodium cantharidale can be preserved without injury in well-closed glasses, and is, for that reason, better adapted than any other vesicant for military hospitals, and for diseases which befal the soldier on his march.

Although the collodium cantharidale is much more expensive than the blistering-plaster, there is a great saving in its use; for one drachm and a half of it is equal to half an ounce of the latter. Its efficacy has been substantiated by several experiments made by Balbiani and Bosse.—*Pharm. Central Blatt.*

FORMULÆ FOR THE PREPARATION OF SEALING-WAX.
By F. X. POTTINGER.

Mr. Pottinger, of Triesch, recommends the following formulæ for the preparation of sealing-wax :—4 oz. of Venetian turpentine are melted with 7 oz. shellac in an earthenware vessel over a slight charcoal fire. Then $2\frac{1}{2}$ oz. of cinnabar and $1\frac{1}{2}$ drachm of carbonate of magnesia are to be mixed with oil of turpentine into a thick paste ; and, having previously added to the first mixture $2\frac{1}{2}$ oz. dry cinnabar, the paste is immediately added ; the whole being constantly stirred until bubbles arise, when the mixture is removed from the fire and stirred till the bubbles disappear. The mass is then poured into tin moulds, the interior of which must be greased with oil of almonds. When the sticks are hardened they are polished by being quickly drawn through a charcoal fire or spirit-flame.

The following formulæ are warranted :—

Fine Red.—4 oz. Venetian turpentine, 7 oz. shellac, 4 oz. cinnabar, $1\frac{1}{2}$ drachm magnesia with oil of turpentine.

Fine Red, No. 1.—The same formula, except $3\frac{1}{2}$ oz. cinnabar instead of 4.

Red, No. 2.—4 oz. of Venetian tupentine, $6\frac{1}{2}$ oz. shellac, $\frac{1}{2}$ oz. colophony, $2\frac{1}{2}$ oz. cinnabar, $1\frac{1}{2}$ drachm magnesia and oil of turpentine.

Red, No. 3.—4 oz. Venetian turpentine, 6 oz. shellac, $\frac{3}{4}$ oz. colophony, $1\frac{3}{4}$ oz. cinnabar, &c.

Red, No. 4.—Turpentine and shellac like No. 3, colophony and cinnabar, each $1\frac{1}{2}$ oz., magnesia, &c.

Red, No. 5.—4 oz. turpentine, $5\frac{1}{2}$ oz. shellac, $1\frac{1}{2}$ oz. colophony, $1\frac{1}{4}$ oz. cinnabar, magnesia, &c.

Fine Black, No. 1.—$4\frac{1}{2}$ oz. Venetian turpentine, 9 oz. shellac, $\frac{1}{2}$ oz. colophony, lampblack mixed with oil of turpentine, as much as is required.

Black, No. 2.—4 oz. Venetian turpentine, 8 oz. shellac, 3 oz. colophony, lampblack, and oil of turpentine.

Yellow, No. 1.—2 oz. Venetian turpentine, 4 oz. shellac, $1\frac{1}{4}$ oz. colophony, $\frac{3}{4}$ oz. king's yellow, $1\frac{1}{2}$ drachm magnesia and oil of turpentine.

Dark Brown, No. 1.—4 oz. Venetian turpentine, $7\frac{1}{2}$ oz. shellac, $1\frac{1}{2}$ oz. brown English earth (ochre), magnesia as above.

Brown, No. 2.—4 oz. Venetian turpentine, 7 oz. shellac, 3 oz. colophony, $1\frac{1}{2}$ oz. English earth (ochre), magnesia as above.

Light Brown, No. 1.—4 oz. Venetian turpentine, $7\frac{1}{2}$ oz. shellac, 1 oz. brown earth, $\frac{1}{2}$ oz. cinnabar, $\frac{1}{2}$ oz. prepared chalk, magnesia as above.

Light Brown, No. 2.—4 oz. Venetian turpentine, 7 oz. fine shellac, 3 oz. colophony, $1\frac{1}{2}$ oz. English earth, $\frac{1}{4}$ oz. cinnabar, 1 oz. washed chalk, magnesia as above.

Dark Blue, No. 1.—3 oz. Venetian turpentine, 7 oz. fine shellac, 1 oz. colophony, 1 oz. mineral blue, magnesia as above.

Green, No. 1.—2 oz. Venetian turpentine, 4 oz. shellac, $1\frac{1}{4}$ oz. colophony, $\frac{1}{2}$ oz. king's yellow, $\frac{1}{4}$ oz. mountain blue, magnesia as above.

Carmine Red, No. 1.—2 oz. Venetian turpentine, 4 oz. shellac, 1 oz. colophony, $1\frac{1}{2}$ oz. Chinese red, 1 drachm magnesia, with oil of turpentine.

Gold, No. 1.—4 oz. Venetian turpentine, 8 oz. shellac, 14 sheets of genuine leaf gold, $\frac{1}{2}$ oz. bronze, $\frac{1}{2}$ oz. magnesia, with oil of turpentine.

Discovery of Coal in Egypt.—The *Journal des Débats* publishes a letter from Grand Cairo of the date of the 1st of August, which announces the discovery, by a French civil engineer, of a stratum of a coal in the vicinity of the Nile, towards Upper Egypt. This discovery will relieve the Government from the tribute paid to England for the purchase of this indispensable article. Two engineers, an Englishman and a Frenchman, were employed, our readers will remember, to investigate the lands in the vicinity of the Nile, for the discovery of a coal, about three years ago ; when they reported that there was none, and that none would be found. The French engineer first mentioned has overthrown this bold assertion. The samples have been referred to a commission, and the excavations will, it is said, be continued on a large scale.

Manufacture of Soap in Scotland.—It appears from a return which has been presented to Parliament that the quantity of hard soap manufactured in Scotland during the year 1848 was 14,187,429 pounds weight, of which 2,869,670 lbs. were made in Leith, 836,630 in Prestonpans, and 9,248,140 in Glasgow. The quantity of soft soap manufactured in Scotland during the same period was 5,738,847, of which 4,246,922 lbs. were made in Glasgow, and 91,620 in Leith. Of 606,420 lbs. of silicated soap, 593,110 were made in Glasgow, and 12,310 in Prestonpans. The number of licences granted to soapmakers n Scotland during the year 1848 was 20.

STATEMENT IN CONTINUATION OF THE ONE PUBLISHED IN THE CHEMICAL TIMES OF SEPT. 8, 1849, SHOWING THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE AIR FROM SEPT. 2 TO SEPT. 8 INCLUSIVE, AS INDICATED BY THE EVAPORATION OF WATER FROM TWO COPPER VESSELS OR SCALES, ONE INSULATED AND THE OTHER NOT. ALSO THE READING OF THE BAROMETER, THERMOMETER, DIRECTION OF WIND, AND GENERAL STATE OF THE WEATHER.

Sept., 1849.	Barometer.		Therm.		Scales.				Wind.		General state of weather.
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Insulated	Non-Insulated	Morning.	Evening.	
2	29.75	29.85	68	67	15 I.	10 N.	15	10	W.	SW.	Fine till seven P.M., when rain set in, accompanied by lightning in the distance from east to west by the south; evaporation very sluggish.
3	29.90	30.00	68	70	5 N.	10 N.	..	15	S.	SE.	Rather cloudy all day; lightning and rain in the evening; evaporation sluggish.
4	30.03	30.10	67	69	5 I.	..	5	..	NW.	NE.	Rather cloudy all day; evaporation sluggish.
5	30.10	30.10	65	68	10 N.	10 N.	..	20	NE.	NE.	Fine all day; evaporation good.
6	30.10	30.13	63	63	5 N.	10 N.	..	15	NE.	NE.	Ditto - - - ditto.
7	30.13	30.20	62	63	5 N.	10 N.	..	15	NE.	NE.	Ditto - - - ditto.
8	30.18	30.08	60	62	5 N.	10 N.	..	15	NE.	NE.	Fine till four P.M.; overcast rest of day.

In the remarks to last week's statement I observed that there was then no appearance of an improvement in the condition of the atmosphere, an opinion I formed from the barometer and scales travelling in opposite directions; and the mortality, I think, has fully justified my conclusion. The mercury, however, now stands at 29.10 only, and there is a slight insulation in the scales; hopes may, therefore, be entertained for the better, especially as there is also a change of wind. With the exception of April, May, and June, the electrical condition of the air unquestionably has not been sufficiently low to cause the present epidemic, although bad enough to maintain the influence when overestablished; and it does not appear that last week, when the scourge was worse than it has been since it first set in, the magnet had lost its power, or the electrical machine its action. Perhaps others more highly favoured than myself in time and means for scientific research may be able to state what was the condition of those instruments in April, May, and June, the almost total absence of the potato disease, and the unusual bountiful harvest this year, affording testimony of the value of my scales, which, at least, renders them deserving of consideration. See remarks to statement published in Chemical Times for July 7, 1849.

Westminster-road, Sept. 11, 1849.

Franklin Coxworthy, Author of "Electrical Condition," &c.

FRANKLIN COXWORTHY'S DISCOVERIES IN NATURAL PHILOSOPHY.

[*Continued from page* 151.]

We venture to assume that we have successfully disposed of the several gases evolved from the atmosphere and from the vegetable kingdom under the respective influences of combustion, respiration, and the decay of vegetable matter; and, in order to complete the investigation, we have now to account for their restoration to the grand reservoirs from which they were originally liberated. This task, it is pleasant to say, it is not difficult to perform; and in its discharge we shall have the gratification of affording to our readers a beautiful illustration of the simple yet ever-efficient manner in which Nature accomplishes her purpose.

The more easily to do this, we must take into consideration another of Franklin Coxworthy's propositions, which, like the two previously given, we place in juxtaposition with the doctrine antecedently received.

Old doctrine.	New doctrine.
That the atmosphere is a mechanical mixture, the elements being held together by diffusion.	That the atmosphere is a chemical compound originally formed and now regenerated by vegetation.

Ammonia, as we have already demonstrated, is contained in great quantities both in snow-water and rain. We have also shown that the combustion of 35,000,000 tons of coal, or carbon, the quantity consumed in this country alone, must yield no less than 130,000,000 tons of carbonic acid, since carbon combines with oxygen in the proportion of 27 to 73; and that, as carbonic acid has a specific gravity of 1.5, it must have a gravitating influence immediately that it acquires a preponderance by contact with the air, and will, therefore, redescend to the globe's surface and combine with water, in which it is highly soluble. The fluid, then, that presents itself to the roots of plants contains:—

Ammonia	Hydrogen Nitrogen	Hydrogen. Air.
Carbonic acid	Oxygen Carbon	Carbon.
Water	Oxygen Hydrogen	Oxygen. Hydrogen.

And we know that the non-nitrogenous portion of the vegetable kingdom abstracts from the sap, or assimilates, hydrogen, carbon, and oxygen, but not nitrogen; the last-named gas, generally speaking, being a constituent of seeds only, and cannot, therefore, form a part of the description of plants to which we have alluded, and of which the forest-tree may be cited as a familiar example.

As far as actual demonstration by extensive experiments might be carried, it is unfortunate that it cannot be added to the inductive reasoning of Franklin Coxworthy in this branch of his discoveries, for want of time and means, both of which, in these days of professed liberality in scientific matters, ought to be placed amply at his disposal. Evidence in his favour, however, is not wanting to sustain his theory. If it is not acknowledged that air is generated by plants—which he maintains to be the case—it is admitted that they yield vast quantities of oxygen, and we know that they possess no smell to indicate the escape of undecomposed ammonia. And as much electricity, the now recognised agent in nature, is set free by vegetation, we must, in the absence of any evidence to the contrary, assent to the probable correctness of his conclusions on this important branch of natural philosophy—that, in fact, a portion of the oxygen disengaged by the tree, from carbonic acid and water, under the high electrical influence of the plant, combines, chemically, with the nitrogen of the ammonia in the reformation of air.

Surely this is a subject worthy of the attention of the philosopher. It is easy of investigation with proper appliances. There is no absurdity involved in it. On the contrary, its proper elucidation may be the means of conferring great benefits to mankind. And, as the chemical section of the British Association is now engaged in ascertaining the correctness of two of Franklin Coxworthy's propositions, the growth of plants in an atmosphere of carbonic acid, and the "breathing" functions of the animals of the carboniferous period, we strongly recommend such an extension of research as shall comprise the three scarcely separable investigations.

THE CHLORIDES OF GOLD.[1]

Great difficulty has hitherto occurred in preparing the chloride of gold, of the yellow and red colours, perfectly soluble in water, and without suffering reduction. The following processes are recommended for this purpose:—

1st. In order to prepare the yellow salt of gold, take aqua regia prepared with three parts of hydrochloric acid, one part of nitric acid, and one of distilled water. Then put one part of pure gold into a porcelain capsule with a plate of glass and heat it in a salt-water bath, the heat being continued till red vapours cease; the cover is then to be removed, and if the gold is not entirely dissolved some aqua regia is to be added to it; the capsule being again covered, the heat is to be continued till vapour ceases to appear; the glass plate must then be removed and replaced by folds of blotting paper, the heat being continued in the bath, until a glass rod, upon being immersed in the capsule, becomes covered with yellow solid chloride of gold.

The capsule is then to be removed from the salt-water bath, when the chloride of gold will speedily crystallize in small prismatic crystals, of a fine yellow colour, with an orange tint. The chloride thus obtained is perfectly soluble in water without reduction: it is successfully employed in daguerreotype and other operations.

The red chloride of gold (terchloride) is prepared in the same manner, except that the aqua regia employed is prepared with two parts of hydrochloric and one part of nitric acid. The operation is commenced by acting upon gold with excess of aqua regia in a sand bath, the salt-water bath not being used until the gold is entirely dissolved; the remainder of the operation is conducted in the same manner as that for the yellow chloride.

Apothecaries'-hall.—The following are the names of gentlemen who passed their examination in the science and practice of medicine, and received certificates to practise, on Thursday, the 13th of August:—Henry Swift, Farnsfield, Nottinghamshire; Theodore Henry Stratton Royle, Stanfield, Norfolk; Thomas Stokes Guppy, Sidbury, Devon; Philip Henry Tribe, Bristol; Richard Barevell, Norwich.

C. Appleby, Sheffield, merchant, for certain improvements in manufacturing files. Patent dated August 25th, 1835; expired August 25th, 1849.

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THE CHEMICAL TIMES.

SATURDAY, SEPTEMBER 15, 1849.

THE CHOLERA, THE DOCTORS, AND THE NEWSPAPER PRESS.

THE Registrar-General seems to be slightly inclined to indulge in over-sanguine anticipations: he is constantly endeavouring to persuade us that we have seen the worst of the cholera. Thus, a fortnight ago we were told by him that "after the perils of this terrible week we seem to see land." His return for last week shows but too clearly that we remain still as much "at sea" as ever; nor does there appear any reasonable prospect of our being speedily relieved from the destructive ravages of the scourge which has now been raging amongst us for the last three months. Still the Registrar-General continues to express his confident hopes that medical skill, combined with the sanitary measures of the Board of Health, will in the end triumph over the foe who has up to this time baffled all efforts to combat and conquer him.

It would be a grievous thing, indeed, for the metropolis if the cholera were to continue its ravages until it should be checked by the measures of the Board of Health, and the experience and skill of the medical practitioners. There can be no doubt but that the disease will in the course of time (perhaps a few weeks) considerably abate in virulence, and ultimately disappear, when the (as yet unknown) cause or causes which generate it shall have ceased to act. But its flight will certainly not be owing to the exertions of the Board of Health, nor to those of the medical profession.

When this awful visitation shall have passed by, the medical profession will be found to remain just as ignorant of the origin, nature, and proper treatment of cholera as they were when that dire scourge made its first appearance on our shores; and this simply because, instead of endeavouring to trace the real causes and to study the true nature of the disease, the great majority of physicians and surgeons have been hunting after "*specifics* and universals"—with what success, let the bills of mortality tell.

We have no hesitation in reasserting that the frightful mortality from cholera is in a great measure attributable to the empiric and irrational treatment resorted to in most cases; and in a greater measure still to the extensive use of the published remedies of the newspaper press. The careless levity with which the *Times* and other journals give publicity to even the most dangerous prescriptions is deserving of the strongest animadversion. "Nowhere," says a contemporary of ours, "has the cholera raged with such virulence as in the columns of certain morning papers;" and we would add, all the graveyards and cesspools of the metropolis have not done half the injury to the public health that these morning papers, and more particularly the *Times*, have done. We had hoped that the case of Sir James Clark's alleged prescription, with its lamentable results, would have proved a warning to the *Times* to discontinue in future the dangerous practice of publishing nostrums against the cholera. Far from it: the *Times* of the 12th instant contains a letter in which tincture of colchicum, in truly poisonous doses, is recommended to the notice of the public as an infallible remedy against the cholera. Now, it is a well-known fact that colchicum, even when administered in small doses, acts most injuriously upon the constitution, and prostrates the vital energies perhaps more seriously and permanently than any other vegetable poison. Even in gout its exhibition is now almost universally considered anything but beneficial to the patient; and yet the public are quietly recommended to try this pernicious poison in large doses! and the gentleman who gives the advice, and who modestly withholds his name, has the assurance to trust that the said tincture of colchicum will, under Divine Providence, prove eminently successful, and soon become generally adopted in this country!

Apparently fearing, however, lest this grand specific fail to meet with the public approbation, he suggests the propriety of trying tartarized antimony, in ten-grain doses; but here he very naïvely admits that the after treatment is difficult, and *that the patient frequently sinks from the effects of the remedy.* We should imagine so: it would require a strong constitution, indeed, to get over *the effects of such "remedies."*

The strict exclusion of all plans or suggestions for the treatment of cholera from the columns of the newspaper press would, in our opinion, go a greater way towards the abatement of that formidable disease than even the closing of two hundred of the metropolitan graveyards.

PROCEEDINGS OF LEARNED SOCIETIES.

PARIS ACADEMY OF SCIENCES.

M. Regnault presented on behalf of M. Blanquart Evrard, of Lille, several specimens of photography on paper, obtained by means of a matrix on albumen, rendered sensible to the action of light, by its admixture with the aceto-nitrate of silver, and spread in a thin layer on a plate of glass. The new matrices obtained by means of the preparations which M. Blanquart Evrard describes in his communication are unalterable to the light; lose none of their qualities however long the time they may be used; are capable of being renewed if by accident they should be lost, provided that one proof of the lost matrix remains; and lastly, can at all times, and under all temperatures and variations of light, furnish satisfactory results. The following is the mode of preparation indicated by M. Blanquart Evrard:—

Collect in a deep vessel a certain number of whites of eggs, remove the whole of the solid or nontransparent part, and take care to protect it from dust; add fifteen drops of a saturated solution of iodide of potassium; beat the eggs into a froth, and allow it to settle until the froth returns to the liquid state. Clean the glass which is to be employed with spirit of wine, place it on a support beyond which the edges of the glass may project, and pour over it a sufficient quantity of albumen; spread this albumen over the whole surface of the glass, employing a piece of glass for this purpose, the edge of which comes in contact with the surface of the glass: this operation must be repeated several times; its object being to cover the surface of the glass with a perfect coating of albumen, so that it may remain well covered when hung up by one of its corners to drain off the excess of albumen.

After this last operation the glass is placed quite flat and allowed to dry. The albumen having been well dried, the glass is submitted either to a very high temperature, or, to what will here effect the same end, to a very low temperature, until the layer of albumen presents a uniform cracked surface. Care, however, must be taken that this part of the process is not carried too far, lest the albumen should peel off. The glass, having undergone this preparation, must next be submitted to the action of a solution of aceto-nitrate of silver (of the strength indicated in the communication of the 20th of January, 1847); care must be taken that the contact of the aceto-nitrate with the albumen shall be effected at one operation, for, if the glass were several times immersed in the solution, different layers would be formed, arising from the contraction which the albumen undergoes on its combination with the aceto-nitrate. This part of the process may be accomplished most readily by proceeding as follows:—In a basin, a size larger than the albumenized glass, is put a solution of aceto-nitrate of silver, to the depth of a quarter of an inch; an inclination of 45° being then given to the basin, the edge of the glass is placed in the solution, the albumenized side towards the bottom of the basin; then by a simultaneous movement the glass is allowed to fall in the basin, and the basin to regain its horizontal position on the table. This done, the glass is immediately removed from the basin, immersed in a basin of water and briskly stirred for several seconds, and lastly drained by holding it by one of its corners and striking the opposite one briskly on the table. Glass thus prepared becomes completely photogenic. It may be employed indifferently, either in a moist or a dry state, if it be required for use at a distance or on a journey. The impression may even be made to appear after exposure to the camera obscura, either immediately or after a return from a journey. This operation is performed (as M. Blanquart Evrard has already indicated for paper in his communication to the Academy in November, 1847) in a bath of a saturated solution of gallic acid; it will, however, be useful, in order to give the impression a full effect, to add a little aceto-nitrate of silver to the solution of gallic acid. It will be prudent to withdraw the impression from its immersion in the gallic acid before its different parts acquire the tone desired, for, if the action be pushed too far, the deep tones it then presents cannot be afterwards diminished, whereas, on the other hand, if the shades are too faint, the impression may without danger be again subjected to the action of the gallic acid, even although the matrix may have already been used to produce a great number of impressions. After this operation the glass should be washed in a large quantity of water, then dipped into a solution of bromide of potassium (20 parts to 100 water), and lastly again washed in a large quantity of water, and dried in a darkened room in an horizontal position. Treated in this way, the albumen on the glass acquires such a degree of hardness and solidity that when it is required to destroy an incomplete impression, in order to use the glass again, it is necessary to have recourse to a very powerful chemical agent, such, for instance, as the cyanide of potassium, to remove the coating of albumen.

THE PUBLIC HEALTH ACT.

In our number of September 1, page 154, we gave an account of that part of the report of the General Board of Health which narrated their proceedings in the execution of the Nuisances

Removal and the Diseases Prevention Act. From the second part of the report, in which they give an account of their proceedings in carrying out the provisions of the Public Health Act, it appears that 150 towns have petitioned the board for its intervention. The board is authorized by the act to interfere in all cases where the deaths, on the average of seven years, appear from the Registrar-General's returns to have exceeded 23 in 1,000. But they state :—

"Without derogation of the duty implied by the power with which we were invested, of directing local examinations to be made where the deaths exceed 23 in 1,000 of the population, we deemed it the most expedient course to direct the first labours of the inspectors upon those places whence petitions were received, or whence applications were made to us from town councils. In all cases we deemed this last class of applications as equivalent to petitions from the ratepayers, whensoever the rate of mortality was such as otherwise to indicate the duty of inspection."

Amongst the towns which have petitioned for the board's intervention are York, Hull, Preston, Lancaster, Durham, Birmingham, Wolverhampton, Brighton, Coventry, Derby, Dover, Leamington Priors, Leicester, Macclesfield, Stratford-upon-Avon, Stoke-upon-Trent, Warwick, Cambridge, Rugby, Eton, Windsor, Harrow, Gloucester, Worcester, Portsmouth, Woolwich, Croydon, and a number of the smaller towns in agricultural districts.

The leading instruction to the engineering inspectors appears to have been as follows :—

"On proceeding to the town to which your service is directed, you will inquire for the list of places required to be made out by the 9th order under the Epidemic Diseases Prevention Act where cases of typhus and other epidemic and endemic diseases have most frequently occurred.

"You will seek the assistance of the clergy and ministers of religion, who may be able to afford valuable aid in your inquiry ; and you will also put yourself in communication with the chief medical officers and the medical practitioners, who, as union surgeons or otherwise, have probably been led most frequently into the houses and streets where epidemic diseases have prevailed.

"You will request the superintendent-registrar of the district to attend your first meeting, with the list of the places of epidemic disease ; you will also request the medical officers to attend at the same time, and also a committee or deputation of the petitioners."

The report states, on these inspections :—

"The experience of the inspectors has been that these directions to the seats of typhus and other epidemic and endemic disease invariably conducted them to places ill drained and surrounded by filth, in which are found the conditions in respect to the removable causes of such disease as were anticipated, and which serve as the foundation of legislation. In the course of the inspections, and after the character of the seats of epidemic disease had been seen by the mayor or other inhabitants who accompanied the inspector, it became a frequent observation to the medical officer, on arriving at an ill-drained and ill-conditioned place, 'Here, sir, you must have fever cases.'

"The positive amount of sickness, pain, premature death, and misery from diseases of this class being, as we find it, constant, or with variations from year to year, chiefly in the way of excess in particular years, the extent to which the causes of such diseases (whether original or predisposing) appear to be removable is a source of proportional hope and satisfaction.

"The feelings manifested by the inhabitants of these, usually the poorest, districts were, in the first instance, surprise at the novelty of an official visit of inspection by an officer acting under the authority of the Government; and, then, satisfaction; next, complaints as to their condition; and, lastly, urgent requests that something might be done for them. They readily threw open their doors, and gave every explanation to the inspectors.

"The extensive manifestation of a sense of their condition by the poorest classes has afforded important promise of the success of the new works contemplated by the Legislature. Had those classes evinced a spirit of resistance to measures of improvement, had they shown a preference for dirt, or an indifference to works of cleansing, their introduction might have been much more difficult; but although the objections to new rates and the pleas of poverty were frequent, as might have been expected, yet where there were opportunities of informing them of the real character of the changes contemplated, and asking them whether they were willing to pay rates in return for the advantages promised, there was a fair, and generally very hearty, expression of good will to do so.

"Another uniform and general result of our procedure upon the lists of the localities of epidemic, endemic, and contagious disease has been that the inspectors' visits of examination have taken guardians of the poor and others to the sources of the greatest chargability to the poor-rates, which they had then almost for the first time visibly displayed before them. Little notice appears hitherto to have been taken of the expense of sickness, of frequent funerals, and of premature disablement and mortality."

Amongst other illustrations of this statement the following are given :—

"As showing the consequences of this state of things to the ratepayers, Mr. Hollins, another witness, said :—

"He had frequently traced a gradual descent to the workhouse from such property as Mr. Clarke had described, whom he had once known as respectable and comfortable in their position as operatives ; unfortunately for themselves and for society they went, through necessity, to live in a house of this class, and he had generally found their hopeless poverty began with six or eight weeks' loss of time through fever and illness caught in such places ; then debts were incurred ; rent, as a consequence, fell into arrear ; goods were distrained ; the man became disheartened ; and the end was pauperism for himself and family. Children once degraded into pauperism rarely regained their former position among the working people ; he had no doubt but that proper sanitary arrangements would prevent much human misery and degradation, and also be a direct money-saving to the parish ratepayers."

On the inquiry at Dover, the relieving-officer, Mr. Davis, stated :—

"That the amount of out-relief for the parishes of St. Mary, St. James, Charlton, Buckland, and Hougham, within the borough of Dover, amounts weekly to £75 17s. 10d., monthly to £263 11s. 4d. ; annually, £3,419 7s. 4d. The total annual amount of poor-rate levied upon the above-named parishes for the year ending March 25, 1849, amounted to the sum of £8,828 12s. 4d. ; from this sum was paid the cost of the in-poor in the workhouse, and likewise a borough-rate to the town council, as well as the out-relief. Of the out-relief, a large proportion goes to Round Tower street and lane, and the low districts of the pier generally ; in the parish of St. Mary, to Barwick's-alley, Paper-alley, the Old Workhouse-ground, including Colbran-street, Brook-street, and other similar places in the parish of Charlton ; in Buckland to a mass of wretched cottages, called Manger's-rents. The largest proportion of out-relief distributed in the places above named is caused by fever, smallpox, and other similar complaints being very prevalent in these localities, caused, I have no doubt, to a very great extent by the closeness of the buildings and their filthy state from want of proper drains and other sanitary regulations."

The report states that the preliminary inquiries uniformly corroborated the previous statements as to the connection between the physical and moral condition of the population.

Other concurrent testimony is adduced, of which that of one witness only need be cited as an example.

"From the experience of upwards of ten years' intimate connection with the poorer classes," continues Mr. Davis, "I have not the slightest hesitation in affirming that there is a most decided direct connection betwixt confined districts, bad sanitary arrangements, and poverty and vice. In the districts above referred to the moral state of the inhabitants is most deplorable. As the youth from these places grow to manhood, they become habitual paupers ; brought up to no regular employment, grossly ignorant and reckless, their time is spent between the union workhouse and the gaol. In conclusion, I can only say, that, if the Government wish to prevent the increase of a most debased and vicious population, they will take measures, if not to sweep away those nests of vice and disease already built, at any rate to prevent similar places from being erected in future."

Amongst other social and administrative results elicited by the local investigations, the following is stated in the report :—

"A further common and important feature observed in these local inspections has been the discovery by the chief inhabitants, or those holding leading local position and office, who accompanied the inspector in his perambulation, how little they themselves knew of the real condition of their own town, or of those portions of it which are occupied by the majority of the inhabitants. The places properly designated as 'fever nests,' the seats of epidemics, it appeared, had never been visited by them, and were almost as much unknown to them as any foreign territory which they had never seen. On these occasions they frequently acknowledged frankly that they had been until then entirely unaware of the condition of the places visited. The town clerk of the town, writing to the inspector, states that they were unaware, until his visit and report, what the condition of their town really was. Mr. Cresy states :—

"'In every instance these opinions I found true. Even at Windsor, the benevolent Rev. Mr. Hawtrey observed, he was unconscious of the state of so much filth ; for, when a clergyman visits the poor, the dirty yard and the privy are seldom exposed to view. At Gloucester, the mayor, and other gentlemen born in the town, acknowledged they were perfectly unconscious of the filthy state of some portions of their city.'"

The following example is given by Mr. Ranger :—

"In the course of my inquiry, the statements of the medical officer, as regarded the wretched state of the numerous courts, alleys, &c., and the wretched state of the dwellings of the poorer class, for want of proper accommodation, water supply, &c., were broadly contradicted by one of a deputation from the boards of highway surveys and inspectors of lighting and watching, whilst another member stated the parish had, on the previous night, passed a vote of confidence in their efficiency and fitness to carry out the necessary measures for improving the sanitary state of the town ; but within a few hours, and in the course of my inspection, at which the deputation attended, it was candidly admitted by the very man who had been foremost in denouncing the statement of the medical man that he had never even seen the places until that day, although a resident in the town for many years, and one of the party in whom the inhabitants had been prevailed to pass a vote of confidence for carrying out drainage, &c.

"The local examinations are concurrent in showing that the outward appearance of our towns affords little or no indication of their real internal sanitary condition, and that even small towns in which the chief streets and thoroughfares, or parts frequented by the higher and middle classes, are clean and well kept, and fair to see, are in other more retired and often immediately contiguous parts in the worst state of filth. It is the most favourable presumption that

the want of information as to the state of the localities visited by epidemic disease is the general cause of their neglected condition, rather than wilful neglect under a consciousness of what that condition really is. It is proper further to note, that the business of the regular inspection of such districts, undertaken from motives of extraordinary zeal and benevolence, is a laborious one, and requires an extent of time and observation inconsistent with ordinary trading or professional pursuits, or with honorary service. The report of the inspectors as to the condition of the populations of the poorer districts is in accordance with the previous reports of visitors from religious associations."

It appears that up to the time of the presentation of the report, about a month ago, in about forty towns these preliminary inquiries had been made, and reports prepared for local publication, containing the recommendations of the inspectors, to which objections might be preferred to the General Board. The inspectors generally asserted that measures of amendment would be in reduction of existing charges. On this topic the report states that:—

"The corporations and the local commissions are usually in debt, and frequently unable to account satisfactorily for the past expenditure. The contrasts between the estimates made by the inspectors upon the improvement in economy, and efficiency of construction which have followed the investigations under the Metropolitan Sanitary Commission, are so great, when compared with those to which the local authorities have been accustomed, that they have frequently incredulously asserted that such works cannot be carried out for any such sums as those named in the reports; nor is it to be expected that they would be, unless under such securities as those to which we must subsequently advert. The entire want of faith in the improvement of the future local expenditure has been one source of the opposition from the owners of the tenements chiefly requiring amendment, for which the highest rents in proportion to any outlay are commonly received. We must, however, repeat, that inasmuch as we believe in every instance the works of amendment proposed will be in reduction of existing charges, and be an improvement to the property, the abolition of cesspools, complete house drainage and cleansing, would, by the reduction of damp, be of full money value to the property by the saving of dilapidations; so we have held that every description of property must contribute; but the owners of the description of property which is supposed to be the poorest, namely, that excused from the payment of all rates on the ground of the poverty of the occupiers, have seen in the imposition of rates for these improvements only a precedent for the rating of that description of property for other purposes, and have been most violent in their opposition. Under the influence of these classes of opponents, poor occupiers, who have expressed their satisfaction at the prospect of amendment, and petitioned for the application of the Public Health Act, have been frequently induced to retract their declarations, and, in some instances, to petition against measures which, however, were nevertheless measures of pecuniary as well as of sanitary relief."

The report describes at some length the grounds of the opposition experienced, chiefly from the owners of the smaller tenements, and sometimes, though comparatively unfrequently, from local party motives. The report states:—

"Considering the provisions made for the satisfaction of the ratepayers with the application of the act, we should hesitate to recommend the enforcement of its provisions against the general and deliberate wishes of the inhabitants of any town, when the intended measures were placed fully and fairly before them. But, in the face of proved facts of preventible evils under which the great bulk of the population of a town may be suffering, we should be cautious in accepting as the real expression of opinion declarations against remedies, unless under scrutinies and precautions, such as experience has suggested in relation to the guises assumed by such interests as those above indicated. We should not accept as expositions of the aversion of 'the people,' or of the unwillingness of the town, declarations which we know to be got up on ignorant or false representations by owners of the worst-conditioned tenements, in respect to which it may be requisite to adopt compulsory measures, or by local functionaries whose powers it may be necessary to supersede; or by one local party in the mere spirit of opposition against the measure which may happen to have been initiated by persons belonging to another, or to no local party whatsoever."

THE HEALTH OF LONDON DURING THE WEEK.

[From the Registrar-General's Return.]

The bills of mortality were commenced in the reign of Queen Elizabeth, and ever since the year 1603 have been published by authority in London. In this respect the English metropolis stands alone; no weekly tables of the causes of the death of every inhabitant are published in the capital of any other European state. Various motives for the measure have been assigned; but the fact of continuous publication from a period anterior to the appearance of newspapers and gazettes is remarkable and characteristic. It may be fairly referred to the natural inclination of the English people when they are in trouble to know the truth, and to see in figures the precise extent of their losses, although at times the sight might well make the courage of the bravest quail. On the Continent "precautions have been used" in publishing the mortality from cholera in 1849, and the deaths from all causes have not yet been made known. The parish clerks of London in the seventeenth century, when the plague was at its height, counted the deaths and recorded their supposed causes; and the citizen, when the death-cart traversed the streets, anxiously studied the bill, surrounded by its gloomy symbolical border, announcing 8,297 deaths in a week out of a population of 600,000. In the hands of Price, Heberden, Willis, Bateman, and other statists, these records have disclosed the laws of mortality, and the causes of the insalubrity of the present cities.

One of their immediate advantages, however, is the evidence which they furnish that the most fatal and threatening plagues go through, with some perturbations, certain prescribed orbits; and, after raging for a given number of weeks, disappear. Plague, influenza, and cholera have been vanquished before; and to despair now would be as unreasonable as it was in the beginning of the year to deny that the cholera epidemic was impending. Those officers who are struggling with the triumphant enemy under every disadvantage will yet be victors; for, if they have art, they have also nature on their side.

The mortality in the week ending Saturday, September 8, declined in the west and east districts of London, and increased slightly in the north and central districts, the deaths registered (1,741) on the north side of the Thames being 19 less than in the previous week. It was otherwise on the south side of the river, where the deaths in the week were 1,442! The total deaths registered in London were 3,183: of males, 1,460; females, 1,723. The deaths of females exceeded the deaths of males by 263, the reverse of the usual proportions. The deaths from cholera were 2,026; the numbers decreased in the districts of Shoreditch, Bethnal-green, Whitechapel, Stepney, Westminster; increased in Bermondsey, St. George, Southwark, Newington, Lambeth, Wandsworth, Camberwell, and Rotherhithe. The epidemic, which had been partially subdued, broke out again with terrible violence in Lambeth, where 279 persons died of cholera in the week.

Mr. Dawes, one of the registrars of Lambeth, who has made careful inquiries on the subject, says, "At least half the cases I have registered were allowed to proceed unchecked until the most alarming and dangerous symptoms had manifested themselves; but lately more circumspection seems to have been used. Nevertheless the cases are still numerous in which persons seem (from the painless nature of the attack) to be unconscious how highly necessary it is that immediate attention should be paid to it." People are so much accustomed to associate danger exclusively with pain that the most fatal symptom, unaccompanied by pain, is neglected. They must, however, be taught to look upon painless diarrhœa with the anxiety that people in the plague looked upon the swellings called "tokens," which were also painless, but with less fear; for the premonitory symptom now seems to be sent, not so much to announce death as to give timely warning, and to call attention to that stage of the malady in which medicine can heal.

As medical skill is of most avail at the beginning and end of a fever, as the effect of the engines is most conspicuous at the outbreak and end of a conflagration, and as most energy is demanded when the wreck nears the shore, so it is in an epidemic, which, if it has not been checked at first, may yet be cut short, and combated with effect, as it declines. None of the measures of relief in any district should, therefore, be discontinued, but be prosecuted with redoubled vigour, until it has been completely subdued; and the districts which have not yet suffered greatly should immediately complete their preparations, for the time is short, and the evils of delay irreparable.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Charles Henri Paris, of Paris, in the Republic of France, for improvements in preventing the oxidation of iron. Patent dated January 23d, 1849. Enrolled July 23d, 1849.

The method described in this specification, of preventing the oxidation of the surfaces of articles made of wrought iron, is to apply to those surfaces glass or other vitreous material, and the process is as follows:—The surfaces of the articles of wrought iron to be coated are thoroughly cleansed by the application of acid, in the ordinary way, or by other convenient means; a solution of gum arabic in water is then applied to the cleansed surfaces, and over this is sprinkled, or sifted finely, powdered glass, or other vitreous material, which is (by the medium of the gum arabic) made to adhere to the surface of the wrought iron. The article is then removed in this state to a suitable oven, or retort, and there submitted to a heat sufficient to fuse the vitreous materials, which spread themselves over the surfaces, and which, upon cooling, are found to adhere closely to the surfaces of the articles. The patentee recommends the employment of the following combination of materials for the purpose, namely, 130 parts of powdered glass, or other vitreous material, 20½ parts of carbonate of soda, and 12 parts of boracic acid, which are to be incorporated together previous to their being applied to the surfaces of the articles. Should there not be sufficient coating upon the surfaces of the articles after one operation, the process may be repeated until sufficient substance is obtained. When it is desirable to form the coating of any required colour, one of the above-described coatings is to be first applied, and then a coating of the coloured glass, or other vitreous material.

The patentee claims—the cleansing the surfaces of wrought-iron articles, and causing to adhere thereto glass, or some other vitreous substance, as described; and also the use and employment of carbonate of soda in the above-described process.

PATENTS RECENTLY EXPIRED.

J. L. Higgins, London, esquire, for certain

improvements in the construction of, and in working, vessels for navigation. Patent dated August 26th, 1835; expired August 26th, 1849.

J. F. Saunders, London, gentleman, for improvements in clarifying raw cane, and other vegetable and saccharine juices; and in bleaching such raw juices. Patent dated September 1st, 1835; expired September 1st, 1849.—(Communication.)

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING AUGUST 30, 1849.

Thomas Symes Prideaux, of Southampton, gentleman, for improvements in puddling and other furnaces; and in steam-boilers. Patent dated August 30th, 1849; six months.

James Robinson, of Huddersfield, in the county of York, orchil and cudbear manufacturer, for improvements in preparing or manufacturing orchil and cudbear. Patent dated August 30th, 1849; six months.

Charles Morey, of Manchester, gentleman, for certain improvements in machinery or apparatus for sewing, embroidering, and uniting or ornamenting by stitches, various descriptions of textile fabrics. Patent dated August 30th, 1849; six months.

George Baxter, of No. 11, Northampton-square, Clerkenwell, late of Charterhouse-square, in the county of Middlesex, engraver and printer, for his invention of improvements in producing coloured steel plate, copper plate, and other impressions. Patent dated August 30th, 1849; six months.—(Being an extension of his former patent for the term of five years.)

Isidore Bertrand, of France, engineer, for improvements in protecting persons and property from accident in carriages. Patent dated August 30th, 1849; six months.

Onesiphore Pecqueur, of Paris, civil engineer, for certain improvements in the manufacture of fishing and other nets. Patent dated Angust 30th, 1849; six months.

Malcolm Macfarlane, of Thistle-street, Glasgow, North Britain, coppersmith, for certain improvements in machinery or apparatus for the drying and finishing of woven fabrics. Patent dated August 30th, 1849; six months.

MR. HUNT ON THE PROBABLE CAUSES PRODUCING CHOLERA.—We have received a variety of letters enforcing further attention to the views of Mr. Hunt, as propounded in our columns last week.—(See *Chemical Times*, page 167 of the present volume.) The following incidental corroboration of them we take from a letter of the Berlin correspondent of the *Times* which appeared in that paper on the 4th instant:—"In the middle of the present month the cholera appeared in a village in the district of Magdeburg, and caused a great alarm from the fatal nature of the attacks, the number of deaths being disproportionately high compared with the number of the population. While the disease was at its height a fire broke out and threatened the whole place with destruction; it required the exertions of nearly all the inhabitants to confine it to the house where it originated: three persons lying ill of the cholera had to be carried out through the flames. It was expected that the terror would increase the disease, but it is a singular fact that the reverse occurred. There has not been a single case since, and the persons rescued from the fire recovered." On the same subject we have received the following letter from Mr. J. A. Barron, of Stanmore:—"I have just read the article in the *Athenæum* on 'The Probable Causes in Operation to Produce Pestilential Cholera;' and, as the friend of Professor Schönbein, and recently from Basle, it may be of some importance that I can confirm what is asserted in the article above mentioned. I have had stated to me by Dr. Schönbein the fact that the atmosphere has for a very considerable period been deficient in ozone; that he himself, a year or two ago, suffered with his family very severely from influenza, when ozone was found by him to be in excess. In one point I must differ from your correspondent—ozone is not Thénard's peroxide of hydrogen. I had previously put it to Dr. Schönbein, 'that his ozone (which he considers deutoxide of hydrogen) might be considered identical with the French chemist's substance,' and did so again in July last; and at both periods he convinced me that ozone possesses properties which entirely distinguish it from Baron Thénard's oxygenated water. If, then, ozone be intimately connected with the prevalence of cholera, and be also entirely distinct from Thénard's oxygenated water, the latter substance may prove ineffectual 'as a remedial agent in Asiatic cholera.'"—*Athenæum.*

THE MAIZE CROP IN THE PARK.—About two months back we mentioned that an experiment had been made in St. James's-park, by permission of the Commissioners of Woods and Forests, in order to ascertain whether the maize plant might be successfully cultivated in this country. We are now enabled to announce the result. It is right to premise that the experiment was made under disadvantages which must be manifest to every practical agriculturist. The spot in which the seed was put down abutted on a nursery of young trees and flowering shrubs, which, as is well known, absorb a large proportion of the nutritive sap of the soil, whilst the foliage deprives the neighbouring plants of the benefit of heat, light, and air, all of which contribute to healthy vegetation. Nothwithstanding these drawbacks, the little maize crop has fully realized all that was anticipated. It was sown the latter end of May, and now in the beginning of September it is ripe for cutting. The appearance of the plant is peculiarly graceful, far more so, indeed, than that of any ordinary corn-field. The stems, which run up perfectly straight, are generally from four to five feet high, and are much thicker than the larger wheat straw. They throw out from the root upwards a succession of flag-like leaves, the stem terminating in a little tuft, from which spring the ears of corn, somewhat irregularly clustered; and in this instanee, apparently, not heavily laden. However, from the concurrent opinion of several practical agrieulturists, many of whom have taken a lively interest in the experiment, it seems not unlikely that the maize plant will be very generally sown henceforward. Its main recommendations are cheapness of seed, rapid growth, simplicity of cultivation, and comparatively large produetion. One important fact, however, must not be lost sight of by those who may feel disposed to speculate in maize-sowing. It requires a sunny aspect and a wam soil. Amongst those who are about to experimentalize upon a larger scale next year are his Royal Highness Prince Albert, who proposes sowing a piece of land at Flemish-farm; his Grace the Duke of Richmond, at Goodwood; and the Duke of Norfolk, at Arundel.—*Times.*

PATENT CAMPHINE AND TURPENTINE COMPANY.—A company has been recently formed for the purpose of carrying out a valuable improvement in the manufacture of camphine and turpentine, and, judging from the samples submitted to us for experiment, we think with every probability of success. We find, upon trial, that the company's camphine, from its great purity, burns with a far more brilliant light than that we have hitherto had in use, at the same time it is perfectly free from smoke or smell. It must be borne in mind that camphine gives nearly double the light of oil, while the saving effected in the use of it is not less than 33 per cent.; but the great drawback to its general introduction has been the difficulty of freeing the liquid from the powerful and unpleasant bituminous odour evolved during combustion, and getting rid of the soot deposited. These serious objections appear to have been most successfully overcome in the patent process alluded to. A far more important point for consideration, however, is the superiority of the company's turpentine over that now in use; they state that its advantages are, that in a liquid state the smell is by no means so powerful as the ordinary turpentine, and when used for painting purposes it evaporates so rapidly as to be quite imperceptible a very short time after use; thus, a sleeping apartment painted in the morning may be used at night without the slightest inconvenience; this is a boon of no small value, when it is considered that the health of painters is injured to a most serious extent by the noxious fumes of the ordinary turpentine; while the annoyance attending painting the interior of a house arising from this cause almost precludes its use. In order to test whether the statements of the company were substantially correct, we caused a surface of about 30 square yards to be painted with it, and it is with great willingness that we bear testimony to the perfect correctness of the assertions that have been made respecting it. Lastly, though by no means least, the price of the patent camphine and turpentine will not exceed the article at presenl sold.—*Patent Journal.*

THE FALL OF THE LEAF.—The increase of leaves, whether in length or in breadth, generally attains its term with considerable rapidity; the leaf exercises its functions for a while, and enjoys the fulness of its existence; but by degrees, in consequence of exhaling pure water, and preserving in the tissue the earthy matters which the sap had carried there, the vessels harden, and their pores are obstructed. This time in general arrives the more rapidly as evaporation is more active; thus we find the leaves of herbaceous plants, or of trees which evaporate a great deal, fall before the end of the year in which they were born; while those of succulent plants, or of trees with a hard and leathery texture, which for one cause or another evaporate but little, often last several years. We may, therefore, in general say, that the duration of life in leaves is in inverse proportion to the force of their evaporation. When this time has arrived the leaf gradually dries up, and finishes by dying; but the death of the leaf ought not to be confounded with its fall; for these two phenomena, although frequently confounded, are in reality very different. All leaves die some time or other; but some are gradually destroyed by exterior accidents without falling, while others fall, separating from the stem at their base, and drop at onee, either already dead, or dying, or simply unhealthy. The main cause is, however, to be sought in the different rates at which leaves and bark grow. So long as they continue to grow at the same rate they adhere to each other; but if, from whatever cause, the leaf grows more slowly than the bark, it drops; or, if the tissue of a leaf contracts suddenly while the bark remains distended, we obtain the same result. The latter seems to be one of the reasons why leaves are instantly cast in the autumn after a sudden frost; the former is the obvious explanation of the fall of evergreen leaves upon the renewal of growth in the spring.—*Lindley's Introduction to Botany.*

THE PROGRESS OF SILK MANUFACTURES IN FRANCE.—Before the revocation of the edict of Nantes, from 1650 to 1680, the number of silk looms at Lyons varied from 9,000 to 12,000. From 1689 to 1699, a few years after the revocation, they were reduced to 4,000. In 1750, under a more tolerant *régime*, the number increased to 12,000. From 1780 to 1788 it was 18,000. The revolution brought down the number to 3,500, and under the Empire the number was 12,000. The re-establishmet of peace brought the number to 27,000 in 1827, 40,000 in 1835, and 50,000 in 1844. Since then the number has kept up notwithstanding the late revolution, with this difference, that the town of Lyons has lost a little, while the country districts have gained. Independently of the circle of Lyons, there may be reckoned at Nismes, Avignon, Paris, in Picardy, Lorraine, and Flanders, about 20,000 looms for silk stuffs and silk lace, 15,000 for various other kinds of silks, and 20,000 for ribands, giving a total of upwards of 70,000 looms. Estimating at 30 kilogrammes the silk per annum for each loom, and at 3,000f. the average obtained from its produce, we shall have an approximative

sum of 300 million for the silk manufacture in France, one half of which is disposed of abroad, and the rest at home.

THE ELECTRIC LIGHT.—The following sensible remarks on the present prospect of the electric light being made practically available for useful purposes are extracted from a recent publication by Mr. J. O. N. Rutter, F.R.A.S.:—"Whether the electric light will ever be so complete, both in its mechanical and voltaic arrangements, as to be of any practical utility, or whether it will remain, as at present, a wonderful illustration of electrical agencies, and nothing further, are questions which must be left for futurity to answer. The man is more bold than wise, and proves himself no safeguard in such matters, who ventures to solve either of them now. That which appears impossible to-day might, perhaps, be easily accomplished to-morrow. The annals of science and of invention are crowded with examples in which one happy thought, one simple condition, one little lever, or wheel, or pinion, has finished, and crowned with success, the labours (with its attendant losses and disappointments) of many years. But we must look also on the other side; and there are found discoveries and inventions and machines without number which, for want of a happy thought, a required condition, a lever, a wheel, or pinion, in the right place, still remain unfinished. In the mechanism of the electric light some improvements have been made. In other respects the progress is remarkably slow. Patent after patent has been granted; years of labour and large sums of money have been expended; but as respects real usefulness nothing seems to have been accomplished. A light of dazzling brilliancy can be shown for a few minutes at a time. Sir Humphry Davy did this; and hundreds of others, some for amusement, some for instruction, have done the same. Steadiness and continuity are qualities essential to all methods of artificial illumination. In each of these qualities the electric light is deficient. If it be so cheap that light equal to 100 candles costs only one penny per hour, if it be so easily managed that it can be as readily adapted in lighting a private house as the most extensive building, and whether the light required be equal to 10, or 100, or 100,000 candles, might it not have been expected that, privately or in public, at least one specimen of the light would have been kept in action for a few hours every night, to have demonstrated its capabilities? Those who understand the details of the process* do not wonder that the electric light is intermitting and uncertain. To maintain, at a high intensity, an uniform power in a voltaic battery is sufficiently difficult; to adjust the carbon points, even by the aid of the most ably-constructed machinery, is apparently impossible. Increase or diminution of power in the battery renders necessary a new adjustment of the carbon. Differences in the quality of the latter, or the admixture of impurities, also interfere with the success of the operations. Machinery, however sensitive, cannot adapt itself to these constantly-varying conditions. It may be perfect in its motions, and exact in its graduations, but still it cannot think about its work, or know what it has to do; and hence, in this instance, it fails in performing all that is required. At one period of the process the carbon point may probably be required to move at the rate of $\frac{1}{100}$th of an inch in a certain time, at another the required rate may be $\frac{1}{1000}$th or $\frac{1}{10000}$th of an inch in the same time. Herein consist some of the practical difficulties. These are only a small part of them. As respects cost, nothing at present need be said. It will be time enough to discuss the economy of the process when all other objections, and especially those of manipulation, are cleared away. If electric power could be obtained without cost, that would not aid the invention. The causes of failure are more recondite than the prices of acids and of metals. In the present state of our knowledge, and notwithstanding all the so-called recent improvements, the electric light remains, what it has hitherto been, a very impressive and very brilliant philosophical experiment, and nothing more."

* The light is produced by a current of electricity, generated by a powerful voltaic battery, and which is transmitted through small cylinders of carbon (charcoal) extremely hard, and as pure as it can be obtained. The points of the carbon are not in contact. The light is formed in the space between them, and is caused by the interruption of the electrical current in passing from one piece of carbon to the other.

POLARIZATION OF HEAT.—The recent experiments of MM. De la Provostaye and P. Desains with solar heat passed through achromatized spar resolve a great number of questions which have not hitherto been worked out in regard to the properties of the calorific rays that become polarized. The principal results are—1st. That the heat that traverses the spar divides itself into two bundles of equal intensities, completely polarized in the plane of the principal section, and in the perpendicular plane. 2d. That the law by which, according to Malus, the intensity of a ray completely polarized is divided between the ordinary and extraordinary images which are produced in the traversing spar is as applicable to heat as to light. 3d. That the variations which the intensity of polarized heat undergoes by reflection from glass at different incidences are exactly represented by Fresnel's formula for light, admitting, for the solar heat which traverses the prism, a sign slightly differing from 1.5. 4th. That the resemblance is still more striking between the phenomena which polarized heat and light present, reflected from polished metals.—*Literary Gazette.*

THE ALLEGED PRESCRIPTION OF SIR J. CLARK FOR CHOLERA.—On Tuesday se'nnight an inquiry took place before the borough coroner relative to the death of an infant, nineteen months old, the son of William and Elizabeth Dowick, who reside in Blundell-street, Liverpool, and whose death, it was alleged, had been occasioned by having had administered to it a dose of the mixture said to have been prescribed by Sir J. Clark for cholera. The evidence of the child's mother, and of Mrs. Crowther, publican, Blundell-street, was to the effect that, after the medicine had been administered, the deceased slept for a length of time, and when he awoke he appeared to be in a fit. He died the same evening, about nine o'clock. The dose given was about a teaspoonful. Mr. John Bold Hyams, surgeon, of Duke-street, deposed as follows:—The deceased was brought to me between four and five o'clock on Saturday evening last. He was at the time in a state of stupor, and very difficult to be roused, and breathed with difficulty. The pupil of the eye was contracted, laboured pulse, and he appeared to be suffering under all the symptoms of narcotic poison. I ordered him resuscitants and everything that might conduce to arouse him from a state of stupor, and excite the vital energy. I saw him again some time afterwards, but he continued to sink, and died in my presence between eight and nine o'clock. I am of opinion that death was caused by some narcotic poison. A teaspoonful of what is called "Sir James Clark's mixture" would be quite enough to have caused the death of the deceased. I have examined the printed prescription now produced (the one attributed to Sir J. Clark). A teaspoonful of the mixture would contain from twenty-six to thirty drops of laudanum. A tablespoonful of it would contain 120 drops, or five grains and a half of solid opium. I consider it a most dangerous prescription; indeed, I may say poisonous. The coroner instructed the jury that, under the circumstances, their verdict must be one of chance medley, which verdict the jury returned, acquitting the mother of the deceased and Mrs. Crowther of all culpability in having administered the mixture to the child. During the progress of the inquiry the coroner sent a request to Mr. Dowling and Mr. Duncan to attend him at his office, and, Mr. Dowling having arrived, he (the coroner) remarked that, when he heard of the medicine having been administered under the sanction of the dock committee, and knowing its dangerous nature, having had the opinion of three medical gentlemen confirming him in this, he thought it was his duty to communicate with Mr. Dowling, and Mr. Dowling would tell them the course which had been adopted. He looked upon the prescription as a most gross and diabolical imposition. Mr. Dowling explained that the medicine, after a consultation of magistrates, had been left at each of the police-stations, and he felt bound to say that it had been taken in a number of cases with a good effect; but the moment he heard that Sir J. Clark had repudiated the prescription he consulted three medical men, and, by their recommendation, another medicine had been substituted; and he thought the more public the forgery was made known the better, and agreed with the coroner upon the propriety of issuing a placard cautioning the public. The coroner hoped publicity would be given to what transpired, and that it would be made known that the mixture was a dangerous and deadly poison; and he looked upon the man who had concocted the prescription, and used the name of a talented man to give it currency, as great, if not a greater, felon than the murderer of Mrs. Henrichson and her family. It was a gross and diabolical forgery.—*Liverpool Courier.*

TO CORRESPONDENTS.

"N. C."—Received.

"Mr. Markham, Wolverhampton."—Your request has been complied with.

"P. T."—Laccine is that portion of shellac which remains after all the matters soluble in water, ether, and alcohol, have been dissolved out. It is a brittle, yellow, translucent substance, soluble in caustic potass and in sulphuric acid.

"A Victim."—We cannot advise you in the matter.

"X. Y. Z."—The eau des Carmes is prepared best as follows:—Take of spirit of balm, 8 pints; lemon peel, 4 pints; nutmegs and coriander seeds, of each 2 pints; rosemary, marjoram, thyme, hyssop, cinnamon, sage, aniseed, cloves, angelica-root, of each 1 pint. Mix, distil, and keep the distillate for one year in an icehouse. This is the original receipt of the barefooted Carmelites, now in the possession of the Company of Apothecaries of Paris, who sell a vast quantity of this celebrated water, which is much esteemed in France as a stomachic, a cosmetic, and a stimulant. A tolerably good substitute for it may be prepared by the following process:—Take of fresh balm flowers, 24 ounces; fresh lemon peel, 4 ounces; cinnamon, cloves, and nutmegs, of each 2 ounces; coriander seeds and dried angelica-root, of each 1 ounce; rectified spirit of wine, 8 pounds. Macerate for eight days, and distil in a water-bath to dryness.

"Mr. Worrell, Kensington."—Flash is a mixture of one gallon of burnt-sugar colouring, and one half pint of fluid extract of capsicum, or essence of cayenne. It is employed to colour spirits, and to give them a fictitious strength. It is made by the brewers' druggists, and vended under the name of "isinglass and burnt sugar."

"P. Q."—Lastcyrie's lithographic ink is prepared as follows:—Take of dry tallow soap, mastic in tears, and common soda in fine powder, of each 30 parts; shellac, 150 parts; lampblack, 12 parts. Melt the mastic and shellac, add the soap and soda, and finally the lampblack; mix intimately, let the mixture cool a little, and pour it in that state into square moulds, or on a slab; in the latter case, cut it into square pieces when cold.

"R. M. S."—1. Yes. 2. The proper proportion is one to five.

"An Apothecary."—The article is liable to the stamp duty.

"P. P."—Write to the commissioners.

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ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXXIV.

(LECTURE CVII.)

VEGETO-ALKALIS—(*Continued*).

COLCHICUM—(*Continued*).

COLCHICUM HONEY.

Take of Dry bulbs of colchicum, 1 part.
Water at 140° Fahrenheit, 16 parts.
White honey, 12 parts.

Crush the bulbs, and let them infuse in the water for twelve hours; strain; let the mixture settle; add the honey, and boil to the consistence of syrup.

TINCTURE OF COLCHICUM.

Take of Dry bulbs of colchicum, 1 part.
Alcohol at 56 Cent. (21° Cartier), 5 parts.

Let the bulbs macerate in the alcohol for some days; strain, and filter.

Husson's anti-arthritic water is prepared with one part of fresh bulbs of colchicum, and two parts of alcohol at 35° Cartier. The dose is five to six drops in a spoonful of water.

EXTRACT OF COLCHICUM.

Take of Dry bulbs of colchicum, any requisite quantity.
Alcohol at 56 Cent. (21° Cartier), a sufficiency.

Reduce the bulbs to a semi-fine powder; moisten this with half its weight of alcohol, and let the magma stand for twenty-four hours; lixiviate it now with three fresh parts of alcohol, and displace the latter finally by means of water. Distil the alcoholic liquors, and evaporate the residue to the consistence of an extract.

From 100 grammes of dry colchicum bulbs I obtained 22.5 of extract.

COLCHICUM WINE.

Take of Dry bulbs of colchicum, 1 part.
Malaga wine, 16 parts.

Let the colchicum bulbs macerate in the wine for twelve days. Strain with expression; filter.

Nieman (in the Dutch Pharmacopœia) prescribes two parts of fresh colchicum bulbs and four parts of Malaga wine.

The following formula, given by Dr. Locher Balber, is very similar to Nieman's:—

Take of Fresh colchicum bulbs, 12 parts.
Wine, 6 parts.
Alcohol, 1 part.

Let the bulbs macerate in the wine and alcohol for eight days.

The colchicum wines prepared according to Nieman's and Balber's formulæ are more potent compounds than that of the Codex. With remedies of this nature it is of the highest importance to guard against the substitution of one for another formula. The physician should, therefore, always most carefully specify the formula according to which he intends the wine to be prepared.

COLCHICUM VINEGAR.

Take of Dry colchicum bulbs, 1 part.
Strong vinegar, 12 parts.

F.S.A.

This is the formula of the Codex.

Take of Fresh colchicum bulbs, 1 part.
Strong vinegar, 12 parts.

F.S.A.

This is Stork's formula.

OXYMEL OF COLCHICUM.

Take of Vinegar of colchicum, 100 parts.
Honey, 200 parts.

Reduce the vinegar by evaporation in the water-bath to 29 parts, and form with this and the honey a mellite by simple solution. Clarify this by Desmarets' method.

ACETIC EXTRACT OF COLCHICUM.

Take of Dry colchicum bulbs, any requisite quantity.
Distilled vinegar, a sufficiency.

Let the bulbs macerate in the vinegar until the soluble parts are dissolved out; strain, filter, evaporate the filtrate to the consistence of an extract.

Scudamore considers this extract to be more powerful than either the aqueous or alcoholic extract of colchicum. Over colchicum vinegar it has this advantage, that the stomach bears it better.

The following formula was suggested to me by Dr. Kapeler:—

Take of Fresh colchicum bulbs, 5 parts.
Concentrated acetic acid, 1 part.

Pound the bulbs, add the acetic acid, and let the magma stand two or three days. Strain (squeeze the grounds strongly), decant the fluid, and evaporate in a porcelain capsule at the heat of the water-bath to the consistence of an extract.

COLCHICUM SEEDS.

Some practitioners prefer the seeds of colchicum to the bulbs, and not without good reason, since the medicinal effects of the former are certainly more constant and uniform than those of the latter.

WINE OF COLCHICUM SEEDS.

Take of Colchicum seeds, 1 part.
Malaga wine, 16 parts.

Crush the seeds, and let the mass macerate in the wine for eight days. Strain with expression; filter.

The action of this wine is generally held to be milder and more certain than that of the wine of the bulbs.

The wine of colchicum seeds is given in doses of eight to ten drops in a cup of tea, morning and night; this dose is gradually increased.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON COLOURING MATTERS.

By Dr. EDWARD SCHUNCK.

[*Concluded from page* 180.]

It remains for me to say a few words in regard to the part which the different substances described above play in the process of madder-dyeing. I regret to say that in my last report there are contained some views on this head which I have found, on more exact investigation, to be erroneous. The two principal points to be determined are, which is the substance that produces the chief effect in dyeing with madder, and why is a certain proportion of lime, either in the plant or in the dye-bath, necessary for the production of fine and durable colours? In my last report I stated it as my opinion that both alizarine and rubiacine take part in the process, that rubiacine alone produces no effect, but that when it is in combination with an alkali or an alkaline earth it forms double compounds with the alizarine compounds of alumina and peroxide of iron, and thus increases the intensity of colour in the latter. I have since found that this opinion cannot be sustained, since rubiacine, whether free or combined, produces no beneficial effect in the process of dyeing, and is therefore no true colouring matter, as the following experiments will show.

Since the brown precipitate produced by acids in a watery extract of madder contains all the free colouring matter of the root, and acts in dyeing in the same way as madder itself, it was evident that by trying the constituents of this precipitate in conjunction with one another, both in a free state and in combination with lime, a correct view of the part performed by each would be arrived at. Having, therefore, taken a piece of calico on which three mordants had been printed, one for red, one for purple, and one for black, in alternate stripes, each stripe being one quarter of an inch broad, and having intervals between them of the same width, it was divided into pieces of six inches by three, and one of these pieces was taken for each of the following experiments. As the tinctorial power of alizarine is very great, so great that one quarter of a grain was enough to overdye one of these pieces, I took one or two grains of crystallized alizarine, dissolved it in a measured quantity of water, to which a little caustic alkali had been added, and was then able to divide the solution into portions corresponding to quarters, eighths, and sixteenths of a grain, so that by precipitating one of these portions with muriatic acid, filtering, and carefully washing, I obtained small quantities in a state very well adapted for dyeing. By treating one of these quantities while on the filter with lime-water, and washing out the excess of lime, I obtained small quantities of the lime compound of alizarine for the same purpose. The same process was used for obtaining small quantities of rubiacine, alpha-resin, beta-resin, pectic acid, and rubian, and their lime compounds. Each experiment was performed with the same quantity of water, at as nearly as possible the same temperature, and occupied the same length of time, viz., half an hour. The substances used, and their quantities, were as follows:—

1. $\frac{1}{8}$th grain of alizarine.
2. $\frac{1}{16}$th grain of alizarine.
3. $\frac{1}{16}$th grain of alizarine and $\frac{1}{16}$th grain of alizarine in combination with lime.
4. $\frac{3}{32}$d grain of alizarine and $\frac{1}{32}$d grain of alizarine in combination with lime.
5. $\frac{1}{8}$th grain of alizarine and $\frac{1}{8}$th grain of rubiacine.
6. $\frac{1}{8}$th grain of alizarine and $\frac{1}{8}$th grain of rubiacine in combination with lime.
7. $\frac{3}{32}$d grain of alizarine and $\frac{1}{32}$d grain of rubiacine in combination with lime.
8. $\frac{1}{8}$th grain of alizarine and $\frac{1}{2}$ grain of pectic acid.
9. $\frac{1}{8}$th grain of alizarine and $\frac{1}{2}$ grain of pectic acid in combination with lime.
10. $\frac{1}{8}$th grain of alizarine and $\frac{1}{8}$th grain of alpha-resin.
11. $\frac{1}{8}$th grain of alizarine and $\frac{1}{8}$th grain of alpha-resin in combination with lime.
12. $\frac{1}{8}$th grain of alizarine and $\frac{1}{8}$th grain of beta-resin.
13. $\frac{1}{8}$th grain of alizarine and $\frac{1}{8}$th grain of beta-resin in combination with lime.
14. $\frac{1}{8}$th grain of alizarine and $\frac{1}{8}$th grain of rubian.
15. $\frac{1}{8}$th grain of alizarine and $\frac{1}{8}$th grain of rubian in combination with lime.

Now, the following results were obtained:—

No. 1 was everything that could be desired in regard to all the colours. No. 2 was of course only half as dark. No. 3 was lighter than No. 1, and the white parts had a pink hue. No. 4 was a little darker than No. 3, but not as dark as No. 1. No. 5 was much inferior to No. 1; the red had an orange hue, the purple a reddish cast, and the black was brown, while the white was yellowish. No. 6 was about equal to No. 1, but not darker, and in no respect superior. No. 7 was about equal to No. 4. No. 8 had almost no colour at all; the red, the purple, and the black were mere tinges of colour, such as might probably have been produced by the tenth part of the quantity of alizarine employed, if no pectic acid had been present. No. 9 was again equal to No. 1. No. 10 was lighter than No. 1, the purple especially being pale and reddish, while the white parts were yellowish. No. 11 was equal to No. 1, but not superior. No. 12 was exactly the same as No. 10, the purple having a disagreeable reddish cast, while the white parts were yellowish. No. 13 was again equal to No 1. No. 14 and 15 did not differ from one another, and were equal to No. 1. Hence we may draw the following conclusions:—Alizarine produces the

greatest effect in dyeing when used alone. The addition of lime, even in very small quantities, does not increase its tinctorial power, but, on the contrary, neutralizes the effect of that portion with which it combines. Rubiacine, the alpha-resin, and the beta-resin, in a free state, when used in conjunction with alizarine, are injurious in about the same degree: they weaken the red, the black, and especially the purple, while they render the white part yellowish. In combination with lime these substances do not increase the tinctorial power of alizarine: they merely allow it to act without hindrance. Pectic acid almost destroys the effect of alizarine. Pectate of lime is perfectly indifferent. Rubian in a free state, and in combination with lime, has neither a beneficial nor an injurious effect. Of all the substances, therefore, contained in madder, none is of use in dyeing but alizarine, while all the others are injurious when in a free state. That which is the most hurtful is pectic acid. When alizarine and pectic acid are present together in the dye-bath, the pectic acid, having most affinity for bases, combines with the alumina and peroxide of iron, and the alizarine crystallizes out when the bath cools, as I noticed in performing the experiment No. 8. The same is without doubt the case when using rubiacine or the resins. The alumina and peroxide of iron combine with these substances to the exclusion of the alizarine; and these compounds are either colourless, or have a poor and unsightly colour. The use of lime is, therefore, easily explained; it serves, not to increase the tinctorial power of the colouring matter, but to combine with and render harmless the substances which are injurious in a free state. Now, if we treat madder with muriatic or sulphuric acid, we remove all the lime and magnesia from it; the pectic acid, the rubiacine, and the resins become free; and, if we wash with water, the muriatic or sulphuric acid is certainly removed; but those substances, being but little soluble in cold water, remain and destroy the effect of alizarine in dyeing. But, if previous to dying we add lime, the pectic acid, the rubiacine, and the resins, being more electro-negative than alizarine, combine with the strongest base, which is the lime; and the alizarine, which is less electro-negative, combines with the weakest bases, viz., the alumina and peroxide of iron. If we add an excess of lime, then of course the alizarine also combines with the lime, and the alumina and peroxide of iron, having no free body to combine with, remain colourless. The process is thus brought into harmony with our previous knowledge of the relative affinity of acids and bases. It is probable that lime is not absolutely necessary for the success of the operation, and that it might be replaced by potash, soda, magnesia, or baryta; but as lime is the cheapest substance that can be used for the purpose it would be of no practical importance to find a substitute for it.

I have in the preceding remarks left xanthine out of consideration. During the process of madder-dyeing this substance no doubt becomes oxidized, and deposits the brown substance mentioned above on all parts of the cloth. This substance, together with the pectic acid, the rubiacine, and the resins, is removed afterwards by passing the cloth through a boiling solution of soap. The alkali of the soap dissolves these substances, which have more affinity for alkalis than alizarine, while the fat acid remains on the cloth in combination with the alizarine, the alumina, and the peroxide of iron.

In order to prove analytically that alizarine is the substance which produces madder colours, I took several yards of cloth which had been dyed purple with madder, but not soaped, and treated it with muriatic acid, which removed the oxide of iron, and left an orange-coloured substance on the cloth. After washing the cloth in cold water until all the acid had been removed, it was treated with caustic alkali. The brownish-red solution thus obtained was supersaturated with an acid, and the reddish-brown precipitate formed was thrown on a filter and well washed with cold water: it was then treated with boiling alcohol. The alcoholic liquid, which was dark yellow, was spontaneously evaporated, and gave crystals of alizarine mixed with a powder resembling beta-resin, and a few yellow micaceous plates, which were probably rubiacine. There remained a brown residue insoluble in alcohol, part of which dissolved in boiling water, and proved to be pectic acid. On treating some cloth which had been dyed with madder, and then soaped, with muriatic acid as before, and then with caustic alkali, I obtained a purple solution, in which acids produced a yellow precipitate. This precipitate was treated with boiling alcohol like the other; it gave a yellow liquid, which on evaporation afforded crystals of alizarine, together with white masses of fat acid. Hardly any residue remained undissolved by the alcohol.

The preceding observations have a great bearing on the manufacture and treatment of garancine. Garancine is the technical name for a preparation of madder, which is obtained by treating madder with hot sulphuric acid until it has acquired a dark brown colour, then adding water, straining, and washing until all the acid is removed. The advantages which garancine has over madder are, that it dyes finer colours, that the part destined to remain white does not acquire any brown or yellow tinge, and that its tinctorial power is greater than that of the madder from which it has been prepared. These effects have been attributed to various causes. It has been asserted that the sulphuric acid destroys the gum, the mucilage, the sugar, &c., and leaves the colouring matter unaffected; hence the greater beauty of garancine colours. To account for the greater proportional effect of garancine, it has been said that a part of the colouring matter is enclosed in cells of the wood, so that it cannot be dissolved by water, and that the sulphuric acid destroys the wood and liberates the colouring matter. To these views it may be objected, that concentrated sulphuric acid, though it does not affect alizarine, does not destroy any of the injurious substances in the root except the xanthine, while the rubiacine, the resins, and the pectic acid, escape its action; and, as far as the wood is concerned, I can affirm that the operation succeeds equally well if acid be taken of such dilution as not to destroy woody fibre. I think that the superiority of garancine can only be attributed to two causes. In the first place, since, as I have shown above, there is a quantity of colouring matter in the root combined with lime and magnesia, by which it is rendered insoluble and incapable of dyeing, one effect of the acid is to remove this lime and magnesia, and to set the alizarine at liberty, which is then capable of application. In the second place, the xanthine, which has an injurious effect in madder-dyeing, is removed by washing with cold water, since it is not precipitated by acids, while the whole of the alizarine remains. If hot acid is employed, then the xanthine, or a part of it, is converted into that dark green substance which I have mentioned above as the product of the action of muriatic and sulphuric acid on xanthine; hence the dark colour of garancine, which is not owing to the charring of the woody fibre, as sometimes asserted. It must be remembered, however, that the rubiacine, the resins, and the pectic acid, as well as the alizarine, remain uncombined after treatment with acid. Hence it becomes necessary to add some base with which these substances may combine, so as not to interfere with the action of the alizarine. I believe it is the practice of garancine manufacturers to employ soda for this purpose. I think it would be better to use a small quantity of lime-water.

I may state in conclusion that the experiments described in this and the last report were made with Avignon madder. The constituents and properties of Dutch madder, which is of rather a different nature, remain to be examined.

I have been lately engaged in examining the colouring mater of fustic, which I have prepared in a state of purity, but the investigation is not sufficiently advanced to justify me in making known the results on the present occasion.

ON THE COMPOSITION OF STEARINE.

By G. ARZBÆCHER.

Induced by the contradictory statements respecting the composition of stearine in Gmelin's "Chemistry," which was the more remarkable as the results had been obtained by some of the most experienced chemists, I made several combustions of stearine prepared from beef and mutton suet.

The stearine was prepared from both suets in the usual manner. Both fats were melted in the water-bath (the beef suet melted at 116°.6, the mutton suet at 122°) and agitated with ether. After cooling, the latter was poured off the crystals, the stearine pressed between paper, and treated four or five times in the same manner. The substance so prepared, after it had been heated sufficiently long in the water-bath to expel the ether, and the melting point was found to be constant at 141° with both stearines, was of a dazzling white colour, very friable, and readily reduced to powder. On being submitted to combustion, the result showed that a distinct formula exists for each separate stearine.

The stearine from beef suet furnished:—

					Mean.
Carbon	78.67	78 62	78.95	78.72	78.74
Hydrogen ..	12.22	12.23	12.22	12 43	12.27
Oxygen	9.11	9.19	8.83	8.85	8.99

The stearine from mutton suet furnished:—

					Mean.
Carbon	76.18	76.60	76.68	76.57	76.50
Hydrogen ..	12.28	12 17	12 17	12.50	12.28
Oxygen	11 54	11.23	11.15	11.03	11.22

In all the combustions oxygen was employed towards the end; and, before the fourth analysis was made, the stearine was again recrystallized from ether, in order to be perfectly sure of its purity. Several grammes, subjected to dry distillation, gave a distillate which, boiled with water, exhibited not the least trace of sebacic acid on testing with salts of silver, lead, and mercury.

It will be seen that the analyses of the stearine from beef suet agree perfectly with those of Chevreul and Lecanu, for they found in 100 parts stearine (C=75):—

	Chevreul.	Lecanu.
Carbon	78.78	78.74
Hydrogen.....	11.77	12.27
Oxygen.....	9.45	8.99

They must, therefore, have employed stearine from beef suet for their experiments, whilst Liebig and Pelouze must have analyzed stearine from mutton suet, since they found:—

Carbon	76.60	76 50
Hydrogen.....	12.29	12.28
Oxygen	11.11	11.22

In accordance with these results, stearine from beef suet would consist of one atom of glycerine with two atoms of stearic acid, less eight atoms HO; and that for mutton suet of one atom of glycerine with two atoms of stearic acid, minus 4HO. The formula of the first would, therefore, be C_{142} H_{134} O_{12}, that of the latter C_{142} H_{138} O_{16}, and the theoretical composition of stearine from:—

Beef Suet.		Mutton Suet.	
C_{142}....	78.74	C_{142}....	76.21
H_{134}...	12.39	H_{138}...	12.34
O_{12}....	8.87	O_{16}....	11.45

100 parts would, therefore, furnish on saponification:—

	Beef Suet.	Mutton Suet.
Stearic acid	98.15	94.90
Glycerine	8.50	8.23

—*Liebig's Annalen*, lxx., p. 239.

ON THE CONSTITUTION OF LEUCINE.

By Professor MULDER.

Gerhardt, Laurent, and Cahours have found a different composition for leucine than the one formerly arrived at by the author. Gerhardt and Laurent state that Mulder found 1 per cent. carbon less than his formula required; but this is incorrect. The numbers which Mulder pub-

lished (Bulletin der Neérlande, 1838, p. 149) give, when they are calculated with the equivalents C=6. H=1, only a loss of ½ per cent.

Gerhardt and Laurent found the subjacent results, which moreover agree with the results obtained by Cahours:—

	G. and L.	Cahours.				
Carbon...	54.60	55.19	55.04	54.86	55.10	12 54.9
Hydrogen	9.99	9 96	10.11	9.96	10.17	13 9.9
Nitrogen.	..	10.63	10.83	10.89	..	1
Oxygen..	..	..	..	..	..	4

Were this correct, the author, in his investigations made ten years ago, must have had a very considerable loss of hydrogen; he was therefore induced to make some further analyses, which again have not given so much hydrogen. The results, compared with theory, from leucine produced from albumen by potash, are as follows:—

Carbon....	54.9	54.8	55 7	12	55.4
Hydrogen.	9.3	9.2	9.2	12	9.2
Nitrogen..	10.5	..	..	1	10.7
Oxygen...	..	..	..	4	24.7

Three other determinations of the hydrogen in leucine prepared from gelatine with sulphuric acid furnished 9.3, 9.3, and 9.3, leading, therefore, again to Mulder's old formula, $C_{12} H_{12} NO_4$. Mulder then requested M. Rost van Tonningen to examine leucine prepared from albumen. He likewise obtained 9.211 and 9.465 hydrogen, and 55.316 carbon.

According to Mulder's experiments of 1838 (Bullet. *l. c.*, p. 180), nitroleucic acid should have the formula I., whilst according to Gerhardt and Laurent it should be expressed by the formula II.:—

I. $C_{12} H_{12} NO_4 + NO_5$, HO.
II. $C_{12} H_{13} NO_4 + NO_5$, HO.

Now, in 1838, Mulder found for the substance dried over sulphuric acid the results given under I., which correspond best with his formula; for, according to that of Gerhardt and Laurent, 7.2 per cent. hydrogen should have been obtained. A recent analysis made by Vlaanderen (II.) likewise confirms Mulder's formula:—

	I.	II.		
Carbon...	37.5	37.2	12	37.3
Hydrogen.	6.9	6.9	13	6.8
Nitrogen..	..	..	2	14.5
Oxygen..	..	..	10	41.4

Consequently Mulder's formula, $C_{12} H_{12} NO_4$, must be retained; and indeed its correctness is rendered most probable by Gerhardt and Laurent's numerical results, for they found in two analyses 52.9 and 52.8 carbon, and 9.3 to 9.4 hydrogen. They supposed that these differences from the results calculated according to their formula should be attributed to an admixture of carbonate of ammonia; but carbonate of ammonia becomes in the air $NH_4 O + HO + 2CO_2$, and contains 10.9 hydrogen; and they ought, therefore, to have obtained more, and not less, water than from pure leucine. It is very probable that a loss of carbon occurs in Mulder's analysis, especially as leucine is burnt with great difficulty.

It is evident that leucine is anhydrous, from its losing no water when mixed and heated with oxide of lead. The muriatic compound mentioned by Gerhardt and Laurent was prepared by Mulder ten years ago. From the statements he then published it followed that the atomic weight of leucine, deduced from two experiments, was situated between 1655 and 1608, whilst the number calculated according to the formula $C_{12} H_{12} NO_4$ is 1625.—*Scheik. Onderzoek*, 1849, p. 371.

ON THE PRODUCTS OF DISTILLATION OF LACTIC ACID AND OF THE LACTATE OF COPPER.

By M. ENGELHARDT.

When a highly concentrated lactic acid is exposed to a temperature of 266° to 284° F., an aqueous, acid, somewhat empyreumatic liquid distils over very slowly. It is dilute lactic acid. When this temperature has been maintained for a considerable time until no more water passes over the brownish-yellow residue forms the anhydrous lactic acid of Pelouze, $C_{12} H_{10} O_{10}$. If the boiling is facilitated by rough substances, &c., the hydrated lactic acid can be brought into a state of ebullition at 392° and be distilled without decomposition; but, without this assistance, whilst a portion passes over which increases in amount according to the height of the temperature, the remainder is converted between 356° and 392° into anhydrous acid.

Anhydrous lactic acid dissolves but very sparingly in boiling water, to which it imparts a bitter taste. In the state in which it occurs forming the residue in the retort, it is a solid, amorphous, brownish-yellow mass, which melts even below the boiling point of water, becomes tenacious on cooling so as to be drawn into threads, possesses an excessively bitter taste, and dissolves in every proportion in spirit and in absolute alcohol. From this solution the anhydrous acid is precipitated by water in flakes, which gradually unite into drops. By prolonged boiling with water, or by long standing exposed to a moist atmosphere, the anhydrous acid is reconverted into the ordinary state. This metamorphosis is very quickly effected by treatment with alkalis and alkaline earths. The anhydrous lactic acid may be exposed to a temperature of 464° F. without experiencing any change; decomposition begins at 482° and is complete at 500°. The products of decomposition (at 500°) are carbonic oxide, with about three to four per cent. in volume of carbonic acid; further, aldehyde, lactide, and citraconic acid, with which is mixed some reproduced lactic acid; no hydrocarbons were found among them, nor could any lactone or acetone, stated by Pelouze to occur among these products, be detected. From one to two per cent. of carbon remained in the retort.

When, in order to separate these substances, the distillate is mixed with water, aldehyde and hydrated lactic acid dissolve, whilst another portion sinks to the bottom as a transparent, yellowish, and at first very mobile oil. When left for some time in contact with water the amount of the oil gradually decreases, and in the course of a few days it has entirely disappeared, leaving behind a few smeary crystals, which likewise dissolve in the course of time. This results more rapidly when a large quantity of water is added, and the whole well shaken or heated. The oil consists of lactide, citraconic acid, and some hydrated lactic acid. That no anhydrous lactic acid distils over as such is proved from the fact that when the contents of the first recipient are allowed to solidify, and are then treated with alcohol, which leaves the lactide undissolved, no lactic acid is precipitated by water from the alcoholic solution.

Aldehyde.—When the distillate, either in the state of liquid or as a crystalline paste, is heated in a water-bath to 212°, and the new product passed into anhydrous ether kept cold, this subsequently yields, on passing ammonia through it, aldehyde-ammonia

Lactide.—The residue from the preceding treatment, from which the aldehyde has been removed, forms a brownish liquid, which in most cases again solidifies to a crystalline paste, which is thrown upon a filter, washed with cold absolute alcohol, and dried by pressure between bibulous paper. In order to obtain large crystals it is redissolved in a little boiling absolute alcohol and set aside to cool. What does not crystallize on cooling is lost, from its becoming converted, both by spontaneous evaporation and by heat, into ordinary lactic acid. The crystals appear to belong to the rhombic system, and exhibit great resemblance to those of the protosulphate of iron. Lactide cakes somewhat together at 248°, and can be sublimed, but it proceeds very slowly. At a higher temperature it melts, sublimes more quickly, and furnishes at 500° the same products of decomposition as the anhydrous lactic acid. Lactide also behaves exactly like anhydrous lactic acid towards water, alkalis, and alkaline earths. It is reconverted into hydrated acid. It is, however, more soluble in boiling water than the anhydrous lactic acid, and again separates for the greater part on cooling in small needles. It has neither smell nor taste, but very soon acquires, with the assimilation of water, a strongly acid taste. Lactide, dried *in vacuo*, furnished on analysis:—

Carbon	49.87	6	50.00
Hydrogen	5.67	4	5.56
Oxygen	44.46	4	44.44

Citraconic Acid is produced only in small quantity. The alcohol with which the crystals of lactide were washed contains this acid and also lactic acid; it is filtered and distilled; what passes over at 428° is saturated with carbonate of baryta, when the salt, which is perfectly insoluble in alcohol, falls as a crystalline paste. This is dissolved in boiling water, from which solution the citraconate of baryta separates on cooling in beautiful nacreous laminæ, which are obtained of the largest size when the solution is concentrated until a pellicle forms on the surface. The air-dried salt lost at 212° 14.82, 14.49, 14.93, and 14.29 per cent., or five atoms of water. The salt, dried at 212°, furnished:—

Carbon... ...	22.57	22.80	10	22.61
Hydrogen ...	1.81	1.93	4	1.51
Oxygen.....	18.15	17.40	6	18.09
Baryta	57.47	57.87	2	57.79

Lactic Acid.—This is left, either in the anhydrous or hydrated state, in the retort in the preceding distillation of citraconic acid.

In one experiment, in which 19.5 grms. of anhydrous lactic acid were exposed to a temperature of 500°, and which was continued for eight hours, the author obtained 12.2 per cent. aldehyde, 14.9 lactide, and 1 per cent. carbon. Several experiments made at the same temperature furnished approximative results. On raising the temperature above 500°, for instance, to 572° and higher, the amount of lactide and lactic acid is diminished, and that of the aldehyde increased. As the disengagement of gas is far more violent, the gases must be much more carefully cooled, in order to prove directly the increase of the aldehyde. The lactide formed is for the greater part decomposed into aldehyde and carbonic oxide by this temperature, which is much above that of the point of sublimation. The decomposition of the lactic acid is, therefore, simply as follows:—

At first lactide is produced, and this is decomposed at a higher temperature into two equivalents of carbonic oxide and one equivalent of aldehyde, $C_4 H_4 O_2 + 2CO = C_6 H_4 O_4$. The presence of carbonic acid and the composition of citraconic acid tend to show that in the distillation there is also a substance containing more hydrogen formed; it was, however, found impossible to isolate it.

Lactate of Copper exhibits two stages of decomposition on destructive distillation. In the first period, which is situated between 392° and 410° F., carbonic acid and aldehyde appear, with a little hydrated lactic acid, the latter probably arising from the crystals retaining some water of crystallization. The retort now contains metallic copper and anhydrous lactic acid, the decomposition of which between 482° and 500° forms the second period. Lactates with strong bases are decomposed in a different manner. The author recommends the dry distillation of lactates with weak bases for the preparation of aldehyde. — *Liebig's Annalen*, lxx., p. 241, and *Chem. Gaz.*

ON THE EXPANSIVE ACTION OF STEAM, AND A NEW CONSTRUCTION OF EXPANSION-VALVES FOR CONDENSING STEAM-ENGINES.

By W. FAIRBAIRN, Esq., C.E., Manchester.*

The innumerable attempts that have been made to improve the principle of the condensing steam-engine since the days of its cele-

* From a paper read before the Institution of the Mechanical Engineers, Birmingham, July 25, 1849.

brated inventor, Watt, have almost all of them proved failures, and have added little, if anything, to the claims, next to perfection, of that great man's ideas. It would be idle to speculate upon the various forms and constructions from that time to the present which have been brought forward in aid of the original discovery of condensation in a separate vessel. All that has been done is neither more nor less than a confirmation of the sound views and enlarged conceptions of the talented author of a machine which has effected more revolutions and greater changes in the social system than probably all the victories and all the conquests that have been achieved since the first dawn of science upon civilized life.

It would be endless to trace the history of the successful and the unsuccessful attempts at improvement which for the last half century have presented themselves for public approval; suffice it to observe, that no improvement has been made upon the simple principle of the steam-engine as left by Watt, and but few upon its mechanism. Among the latter may be enumerated the improvements in the construction and mode of working the valves; and of these the D valve, by the late Mr. Murdoch, and the use of tappets as applied to the conical valves, appear the most prominent and the most deserving of attention.

In the construction of the parallel motion, the application of the crank, the governor, and the sun and planet motions, all of which have risen spontaneously from the mind of Watt, there is no improvement. The principles upon which all of them are founded have been repeatedly verified beyond the possibility of doubt, and their mechanism is at once so exceedingly simple and so ingeniously contrived as to limit every attempt at improvement in those parts of the steam-engine. What appears to be the most extraordinary part of Mr. Watt's engine is its perfect simplicity, and the little he has left to be accomplished by his successors.

It will be in the recollection of most persons conversant with the steam-engine that the hand gear for working the valves by the air-pump or plug-rod gave a self-acting and continuous motion to the machine; and the facility which these means afforded for moving the engine in any direction and at any required velocity gave it a degree of docility and power beyond the expectation of its most sanguine admirers.

For a considerable length of time the hand gear was the best and the most effective mode of applying the motion of the steam-engine to the valves; subsequently the oscillating and revolving tappets, fixed upon a shaft and driven by wheels or an eccentric, came into use, and by means of vertical rods communicated motion to the valves, and thus a similar effect was produced as by the hand gear; next came Mr. Murdoch's D valve and eccentric motion, which for simplicity has never yet been equalled. The D valve and the flat plate valve are nearly synonymous, with this difference only, that the D valve presses with less force upon the face, and, consequently, works easier than the flat valve, which in every case is exposed to the full pressure of steam. It is true that means have been adopted to obviate this objection in large engines by a preparation on the back of the valve, which is made steam-tight, and by a communication with the condenser a vacuum is formed over a proportionate area of surface, sufficient to equalize the pressure and admit an easy motion of the valve.

The expansive principle upon which steam-engines are now worked, and the economy which this system has introduced in the expenditure of fuel, have effected considerable changes in the working of the valves, and have rendered the D and plate valves almost inadmissible for such a purpose. To the skill, ingenuity, and careful attention of the Cornish engineers we are indebted for many of the improvements connected with the use and application of expansive steam; and taking into account the high price of coals, and the urgent necessity of economy in those districts, combined with a system of registry and encouragement held out by premiums, as described by Mr. John Taylor, we may reasonably conclude that other parts of the kingdom have been greatly benefited by the excellent examples set before them by the Cornish miners and engineers.

For a great number of years, and up to a recent period, the economy of steam and the working of the steam-engine expansively were but imperfectly understood in the manufacturing districts; and, although the Cornish miner set an excellent example and exhibited a saving of more than one half the fuel, there were, nevertheless, few if any attempts made to reduce what is now considered an extravagant expenditure in most, if not the whole, of our manufactories. But, in fact, the subject was never brought fairly home to the millowners and steam-navigation companies until an equalization or reduction of profits directed attention to the saving attainable by a different system of operation.

Ten years ago the average or mean expenditure of coal per indicated horse power was computed at from 8 to 10 lbs. per horse power per hour, but now it is under 5 lbs. per horse power per hour in engines that are worked expansively, and even then they are far below the duty of a well-regulated Cornish engine, which averages from $2\frac{1}{4}$ to 5 lbs. per horse power per hour.

This difference in the consumption of coal may be attributed to two causes: first, the conditions under which the duty of the two engines (that of the Cornish miner and the manufacturer) are respectively performed. The first, being chiefly employed in pumping water, has the benefit of alternate action in overcoming the inertia of a large mass of matter, which when once in motion is easier continued, for a definite time, than a continuous power of resistance, such as exhibited in corn and cotton mills. Another cause is the great care and attention which the Cornishman pays to his boilers, steam-pipes, &c. They are never left exposed, but are carefully wrapped up in warm jackets, and well clothed to prevent the escape of heat. Even at the present day it is lamentable to see (in the coal and iron districts) the great and extravagant waste that is continually going on, for want of a little considerate attention in this respect; the only excuse is the cheapness of the fuel. But that is not an excuse, for if one half can be saved, and coal could be got at one shilling per ton, it is certainly desirable to save sixpence out of the shilling when that can be accomplished at a trifling expense. But one of the chief, if not one of the most important, reasons for the exercise of economy in fuel is the reduction of profits on articles manufactured by power. Under these circumstances a saving in coal becomes a consideration of some importance, and to these reductions alone may be traced the powerful stimulus which of late years has been prevalent in that direction. The low rate of profit in manufacturing operations, and a desire to economize and reduce the cost of production to a minimum, have been of great value in their tendency to improvement in the economy and efficient use of fuel, and also to the use of high-pressure steam and its expansive action when applied to the steam-engine. In France and most other parts of the Continent this system has been long in use, and, although its effects as well as its economy have been long known in this country, it was only within the last few years that the benefits arising from it were appreciated. For a great number of years a strong prejudice existed against the use of high-pressure steam, and it required more than ordinary care in effecting the changes which have been introduced. It had to be done cautiously, almost insidiously, before it could be introduced. The author of this paper believes he was amongst the first in the manufacturing districts who pointed out the advantages of high-pressure steam when worked expansively,* and for many years he had to contend with the fears and the prejudices of the manufacturers, before the present system of economical working was adopted.

The first attempt was by improvement in the construction of boilers,* and subsequently in the valves of the steam-engine, adapted to either low or high pressure steam when worked expansively; the latter of which it is the principal object of the present paper to develop.

The expansive action of steam has been variously estimated by different writers, but all seem to agree in opinion that a considerable saving is effected by that process. It therefore becomes a question of importance, in a community whose very existence almost depends upon the steam-engine, how to work it advantageously and at the least possible cost. The great variety of schemes and forms which have been adopted for the attainment of these objects have been exceedingly various, ingenious, and interesting; and the investigation of the different theories and applications that have been submitted for public approval would form an exceedingly attractive, if not a useful, history of the various discoveries to which we are in a great measure indebted for the present improved construction of the steam-engine.

The elastic force and expansive action of steam were well known to Mr. Watt and some of his immediate contemporaries and successors, such as Smeaton, Cartwright, Woolf, Trevithick, and others; but the fears entertained of explosion at that early period, and the difficulty of constructing vessels strong enough to contain high-pressure steam, were probably the greatest drawbacks to its introduction. Woolf and Trevithick were probably among the first to grapple with this dangerous element; and the former, in order to economize fuel, introduced the double-cylinder engine, whereby a great saving was effected by increasing the pressure of steam in the boiler, and allowing it to pass from one cylinder to another of three or four times the capacity, by which its volume was expanded; and by these means a saving was effected and an extra duty performed. If, for example, taking a double-cylinder engine, the high-pressure cylinder being one quarter of the capacity of the cylinder from which the steam is condensed, there will be for one cylinder-full of steam an expansion of four times its volume; this, of course, with a diminished pressure in the ratio of the capacities of the two cylinders. Comparing this with a similar process in a single cylinder equal in capacity to the two cylinders, and fitted with a well-constructed apparatus, regulated so that only one fifth of the contents of the cylinder (equal in capacity to the small cylinder on Woolf's plan) is filled with steam of equal density, and the remaining four fifths (equal in capacity to the larger cylinder) is allowed for expansion. it is evident that, the communication being thus suddenly cut off from the boiler after the piston has been urged through only one fifth of the length of the stroke, the expansive force is then used in completing the remaining four fifths of the stroke, and the result must be nearly the same as that obtained with the two cylinders on Woolf's plan. The advocates of Woolf's system, however, insist upon its superiority, not from the actual force given out (which is rather in favour of the single cylinder than the double, in consequence of increased condensation in the steam passage between the two cylinders), but from the superior action and greater regularity of motion which in the former case is produced. To some extent this is the case, but not to any appreciable amount, provided the fly-wheel is well proportioned to the pressure and power at which the engine is worked. In the double engines which are now in common use, that is, when two single engines are coupled together with the cranks at right angles to one another, there is less occasion for a heavy fly-wheel, as the effect of a large expansion is less felt, if not

* See paper read before the Geological Society of Manchester, in the year 1840, on the Economy of Fuel.

* See Report on the Prevention of Smoke and Economy of Fuel.—Transactions of the British Association, 1844.

effectually neutralized. The results, therefore, of the double-cylinder engine and the single engine, working at equal rates of expansion, are virtually the same as regards power and economy of fuel, if the comparison be not in favour of the single engine.

Having come to the conclusion that the same duty can be performed by the single as by the compound engine, and considering the important advantage of simplicity in mechanical construction, in opposition to complexity, however ingeniously contrived, it becomes a question how to obtain an effective as well as a simple process for the attainment of that object.

The first attempt was by revolving tappets, which had been long in use; these being formed and regulated in such a manner as to cut off the steam at such a point of the stroke as to give the exact quantity of expansion required. These tappets, to say the least, were, from various reasons, objectionable, as the weight of the vertical rods and the slowness of motion prevented them from producing the desired effect. The steam-valves could, however, be fixed so as to cut off the steam at the required point of the piston passage in the cylinder; but the motion is not effected with the velocity essential to an efficient process of expansive action. Other processes have been tried for working steam-engines expansively, besides those already noticed; amongst them may be noticed the equilibrium-valve, worked by double cams from the crank-shaft. This method is generally used and adapted to the marine and old engines; but its application is seldom of much value, unless the engines and boilers are capable of bearing a pressure of 15 lbs. to 20 lbs. on the square inch.

Another fault to which this description of valves is subject is, their distance from the steam-ports into the cylinder, and the large quantity of steam which occupies the space between the cut-off valve and the working cylinder of the engine.

To remedy these defects, and to apply a better system of expansion to the common condensing engines, the following apparatus and mode of working the valves was introduced.

In giving a description of this effective and simple apparatus, it is but fair to state that the first idea of this invention was suggested by Robert Brownhill, at first imperfectly constructed, but since greatly modified and perfected by the author of the present paper.

* * * * *

In the construction of a steam-engine two important considerations present themselves,—the attainment of a maximum of force, and the minimum in the consumption of fuel. To acquire the first it is requisite to form such an arrangement of the working parts as to obtain the closest approximation to a perfect vacuum under and above the piston, and the other is accomplished by having as small an expenditure of steam as possible. These desiderata are, to a great degree, attained by the principle upon which these valves are constructed, and the way in which they are worked. Each of the steam-chests contains two double-beat valves, one for the admission of the steam to the cylinder, and the other for its escape into the condenser; also the shut-off valve and the throttle-valve; and these valves constitute the whole of the openings by which the steam is admitted and returned from the cylinder. All the four valves are of the same area and dimensions; but the steam-valves are not lifted up so high as the exhaust-valves, for the reasons which are afterwards given. The double-beat valves of this construction have certain proportionate areas, the upper portion being larger than the bottom, in the ratio of 1.158 to 1.000. The object of this enlargement of the upper part of the valve is to give a preponderance to the pressure of the steam on the top side, in order to overcome the pressure of the packing in the stuffing-box which embraces the spindle, and to assist the gravitating force of the valve in its descent when liberated from the cams.

The mode of working the valves is by shafts and wheels, which derive their motion from the crank-shaft, and revolve at the same speed. A vertical spindle, upon which two circular discs, P P, are fixed, passes through the steam-chests, and by its rotary motion the cams which are fixed upon these discs raise the valves as they pass under rollers, which are connected to the valve spindles by cross heads, M M. By these means the valves are raised and retained open or shut for any definite period. The rollers are steadied by the cross heads sliding upon the vertical guide-rods, at their outer ends, and sliding at their inner ends in vertical grooves in a centre boss, which is supported by the guide-arms.

To work this engine economically, much depends upon the pressure of the steam and the amount of expansion given to the valves. The usual practice is to work with steam, at 15 lbs. on the square inch, and cut off at one half the stroke, and expand the other half; but in other cases, when the engines and boilers are calculated to bear a high pressure of steam (say from 30 to 40 lbs. on the inch), the cams are formed so as to cut off the steam at one third or one fourth of the stroke. There are generally three, and sometimes four, cams upon each of the discs, so as to cut off the steam at one half, one third, or one fourth, or at any other point corresponding with the force of the steam and the load respectively.

To obtain this range of expansion, the rollers which work the steam-valves are moveable, by brass strips which slide in the grooves in the cross heads, so as to bring the rollers over any one of the cams that may be required; and there are fixed pointers which show, by a graduated scale on each brass slide, the exact point of the cylinder at which the steam is cut off, and by these means the extent of expansion is regulated, and brought under the eye of the engineer.

It has already been stated that the steam-valves are not lifted so high as the exhaust-valves, and the reason of this is, that as the exhaust valves are not variable in their action, and always require full openings into the condenser, it is desirable to retain them open throughout the whole length of the stroke. This process is effected with a greater degree of certainty than by any other description of valve. The exhaust-valves are raised suddenly by the short inclined planes of the cams, and, having allowed time for the escape of the steam from the cylinder through a wide passage into the condenser, they suddenly fall by gravitation, and thus a more complete vacuum is formed under the piston than is probably attained by any other process.

The working of these valves is effected with a degree of certainty and simplicity which renders them very satisfactory, both as regards their efficacy in conducing to the economy of steam, and the perfect ease with which they are worked.

NINETEENTH MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

BIRMINGHAM, SEPTEMBER 13.

Section A.—Mathematical and Physical Science.

President—Mr. W. Hopkins, F.R.S.

Vice-Presidents—Rev. E. H. Gifford, Sir W. S. Harris, Mr. J. C. Adams, the Dean of Ely.

Secretaries—Professor Stevelly, Messrs. G. G. Stokes, W. R. Wills.

Committee—Lord Adare, Captain Sir E. Belcher, Mr. C. Brooke, Sir D. Brewster, Mr. Birt, Rev. Professor Chevallier, Dr. Evans, Mr. T. W. Gray, Professor Hodgkinson, Mr. J. P. Joule, Rev. J. King, Dr. Lee, Rev. Dr. Robinson, Mr. F. Osler, Professor Phillips, Rev. Professor Powell, Mr. F. Ronalds, Colonel Sabine, Colonel Sykes, Professor Wilson, and Lord Wrottesley.

The president on taking the chair briefly stated the object of the association and the usual mode of working the sections.

Mr. Ronalds handed in his annual report "On the Kew Observatory," from which it appeared that the observations have, from the deficiency of applicable funds, been discontinued since the meeting in 1848; but a sum having been then voted for completing certain experiments in progress, and another sum for the reduction and discussion of the series of electric observations which commenced in August, 1843, and terminated in 1848, the last year's work has been principally devoted to these objects; and it was deemed that good service has been rendered to the modes of magnetic investigation by this employment of the Observatory. The report proceeds to give an account, as usual, of the state of the establishment, including a complete inventory of the contents of the building. Then follows Mr. Birt's discussion of the electrical observations—occupying a much too large part of the volume to be read, and, therefore, left for Mr. Birt to report afterwards in substance. A summary specification of the experiments of the year was given, viz.:—1. On the management of the light admitted into Mr. Ronalds's camera by suppressing his usual condensing lenses and bringing the index of the magnet nearer to the lamp, by which means the time required for producing an efficient image on the paper was materially diminished. An improvement on Count Rumford's polyflame lamp was useful for heightening the brilliancy of the flame itself. 2. Experiments intended to determine the comparative advantages of a slit in a shield and the index which had been hitherto used. The slit was found far preferable in the case of large and sudden excursions—such as those occurring in Canada. 3. On the comparative advantages of the daguerreotype and talbotype processes. The former was found for all these uses preferable, confirming Colonel Sabine's anticipations. 4. Several experiments, more or less successful, on modes of copying the impression of the mercury on the plate, in which assistance was derived from Mr. Malone. 5. Experiments of etching, either by the mezzotinto or dry-point method, on the daguerreotype plate itself, with a view to the circulation of the original observations, the plate remaining serviceable for a few more mercurial impressions. 6. Experiments suggested by Dr. Lloyd for procuring on the plate the same kind of zero line for measuring ordinates as Mr. Ronalds had from the first procured upon paper, &c. 7. Experiments for the construction of an instrument for measuring ordinates of magnetic and other curves from the above-mentioned zero line, or in other instances. 8. Experiments for the improvement of daguerreotype apparatus for the process of cleaning, polishing, and coating plates used for the purposes of these observations, with some other experiments of less consequence. The volume further contains the full details, illustrated with five plates, of the apparatus, resulting in part from the foregoing series of experiments, and sent by Colonel Sabine to the Toronto Observatory for immediate use. An advantage of this arrangement is that no hygrometric expansion or contraction can have sensible effect on the required results. Mr. Ronalds's correspondence on the subjects of electricity and magnetism seems to have had beneficial results. In the last place is presented, as usual, a list of proposals for new experiments at Kew, extending to twelve heads, one of the most urgent of which Mr. Ronalds considers to be the prosecution of experiments commenced at the Observatory in 1845, and suspended for want of funds, on the important subject of frequency of atmospheric electricity, a subject unaccountably neglected since the observations of Beccaria, at Turin, in the middle of the last century, and one which seems to Mr. Ronalds to grow in importance with the growth of our chemical and magnetical information. Others of these proposals embrace a course of inquiry in magnetism, electricity, and various meteorological phenomena, all requiring only a sufficient observatory staff to be beneficially carried out.

"Report on the Discussion of the Electrical Observations at Kew," by W. R. Birt.—The author stated that 15,170 observations of atmospheric electricity, made during a period of five years, contributed to the deduction of the results detailed in the report. Of these 14,515 were positive and 655 negative. The positive observations had furnished the data for determining the ordinates of the diurnal and annual curves of atmospheric electricity, especially during the three years 1845, 1846, and 1847, to which 10,176 observations contributed. The result of the discussion with reference to the diurnal curve is as follows:—From the mean of the three years at each observation hour, viz., every even hour, Greenwich mean time, throughout the day and night, it appeared that the tension of atmospheric electricity is at a minimum at 2 o'clock in the morning; from this hour a gradual rise takes place until 6 a.m., after which hour the tension rises rapidly, the value at 8 a.m. being nearly double of that at 6 a.m.; the increase is then more gradual until 10 a.m., the epoch of the first or forenoon maximum; from this hour the tension gradually declines until 4 p.m., when its value is but slightly above the value at 8 a.m. This second minimum the author terms the diurnal minimum, as distinguishing it from the nocturnal at 2 a.m. After this the tension rapidly increases until 8 p.m.; and after a slight rise to 10 p.m.—the epoch of the principal or evening maximum—the upward course of the tension is completed. The evening maximum is rather considerably elevated above the forenoon maximum at 10 a.m. Between the hours of 10 p.m. and midnight the tension declines to nearly the value of the nocturnal minimum. In treating of the annual period the author remarked that the lowest tensions are exhibited in June and August, the tension of July being rather above that of either of the before-named months. During September a small rise occurs, which is increased in October; the augmentation becomes more rapid from November to January, and then receives a check, the February increment being less than either of those of December and January. In February the maximum is attained; it is succeeded in March by a very rapid diminution of tension, which continues through April and May, the decrements becoming less in value until June, the month presenting the lowest tension. In connection with this part of the report the author solicited attention to the close connection which appears to exist between the electric tension and the humidity of the atmosphere, the records of the Observatory at Greenwich furnishing the means of comparing the two elements. With respect to the diurnal period, the author also infers that the higher tensions exhibited by the electrometers are more or less connected with the humidity of the atmosphere, especially the moisture enveloping the collecting lanthorn. With the view of illustrating this point, he divided the entire series of observations into two sets, one of high the other of low tensions, as well as specifying in each division the summer and winter observations, and found that the high tensions in the winter materially influenced the results deduced from all the observations in the winter, and those again materially influenced the results appertaining to the entire year. The correspondence between these results and those of the discussion of the annual period tended greatly to confirm his inference that the positive tensions, especially those of a high value, are more or less due to the humidity present in the atmosphere. The discussion of the observations at sunrise and sunset, 3,367, illustrates to a great extent the annual period. As these observations extend over a period of five years, the curves are more regular than that deduced from the observations of three years. In accordance with the results having reference to the diurnal period, the sunset curve is found to be superior to the sunrise, *i.e.*, the electric tension is higher at sunset than it is at sunrise. In the sunrise and sunset curves the maximum occurs in January instead of February; in other respects there is considerable accordance between the annual periods. In discussing the negative observations the author pursued altogether a different course, the occurrence of negative electricity as compared with positive being rare. He first assembled all the cases of positive electricity that occurred in the seventeen months prior to 1845, and compared each observation with the records for the same period at the Observatory, Greenwich. The principal results of the comparison are:—First. That, when the conductor has been negatively charged, rain, generally heavy, has mostly been falling; the instances when rain has not fallen, the charge being negative, are very rare—only ten out of 231; Second. These ten instances, with the assistance of the Greenwich observations, have enabled the author to infer that the negative charge is derived more immediately from the cloud precipitating the rain, a particular kind of cloud, cirrostratus, in almost every instance having been observed at Greenwich when the conductor has been charged negatively at Kew. From this he apprehended the possibility of obtaining a diurnal period of negative electricity more or less in accordance with the diurnal period of cloudiness; and with this view he discussed the remaining 424 negative observations. The result is perfectly in accordance with that of the discussion of the preceding seventeen months; the greater occurrence of negative electricity, as well as its increase of tension, coinciding within certain limits with the greatest development of cloud, the epoch being about the middle of the day. The results of the entire discussion cannot be better expressed than in the words of the concluding portion of the report:—"In both instances (the positive and negative) the humidity and cloudiness precede the electricity, and strongly indicate that whatever relation may exist between the development of positive electricity and humidity on the one hand, and that of negative electricity and cloudiness on the other, such relations are not only likely to be of very constant character, but that a similarity exists between the two sets of phenomena, which goes far to show that the nature of their connection, if any, is also similar: the one, namely, positive, principally indicating the electric tension of aqueous vapour; the other, namely, negative, the electric disturbances produced by the sudden precipitation of this vapour when existing as cloud."

SECTION B.—CHEMISTRY, INCLUDING ITS APPLICATIONS TO AGRICULTURE AND THE ARTS.

President—Dr. Percy, F.R.S.

Vice-Presidents—Professor Apjohn, Professor Graham, Mr. R. Phillips, Dr. Miller, Dr. Andrews, Mr. J. Gassiot.

Secretaries Messrs. G. Shaw, R. Hunt.

Committee—Dr. Faraday, the Marquis of Northampton, Dr Schrœter (Vienna), Professor Magnus, Professor Daubeny, Dr. L. Playfair, Messrs. W. West, T. Pearsall, Professor Forchammer, Dr. De Vry. Dr. Schunck, Messrs. W. H. Pattison, R. Warrington, T. Ward, G. Feschmacher, Professor Ronalds, Messrs. J. P. Joule, R. Mallet, Dr. Scoffern, Capt. T. L. Lewis, Dr. Gladstone, Professor Wilson, Professor Rinman.

"On the Combined Use of the Basic Acetates of Lead and Sulphurous Acid in the Colonial Manufacture and the Refining of Sugar," by Dr. Scoffern.—Dr. Scoffern, after a few preliminary remarks on the anomalies which beset the colonial sugar-manufacturing functions, stated the actual amount of pure white and crystallizable sugar existing in the sugar-cane juice to be from 17 to 23 per cent., and the amount of juice contained in the cane to be about 90 per cent.: of this amount only 60 per cent. on an average is extracted, and of this quantity only one third part of its sugar is obtained, in a dark impure condition, instead of white and pure as it might be extracted. The operation at present generally followed in the colonial production of sugar involved the use of lime, an agent which, although beneficial in separating certain impurities and decomposing others, effects both these agencies at the expense of two thirds of the original sugar. Curious plans had been followed to avoid the use of lime; alumina, in its hydrated condition, had been employed, but with inconsiderable success. As a purifying agent the basic acetate of lead was known to be most potent, but could not be generally employed, owing to the existence of no sufficient means of separating any excess of that agent which might remain. Dr. Scoffern effects this separation by means of sulphurous acid forced by mechanical means into the sugar solutions. The process had been used for more than twelve months in one of the large British refineries, and a lump of sugar prepared by means of the operation was exhibited The advantages presented by this operation were thus summed up:—1. As applied to cane-juice, and other natural juices containing sugar, it enables the whole of the latter to be extracted instead of one third as is now the case; and in the condition of perfect whiteness, if desired, without the employment of animal charcoal. Owing to the complete separation of impurities the juice throws up no scum when boiled, and therefore involves no labour of skimming. Finally, the process of curing is effected in less than one third of the present time, and the quality of the sugar being in all cases so pure and dry, no loss in weight occurs during the voyage home. 2 As applied to the refinery operation, it enables the manufacturer to work upon staples of such impurity that he could not use them on the old process. It yields from these staples a produce equal in quality to the best refined sugars produced heretofore—in larger quantity, and in less time. It banishes the operation of scum-pressing, the employment of blood and lime. Finally, its cost is even less than that of the present refinery process.

Dr. Miller remarked that it had been objected that sulphurous acid absorbed oxygen, and, passing into sulphuric acid, impaired the grain of the sugar. Dr. Playfair said it had been stated that sulphurous acid gave a taste to the sugar. Dr. Scoffern observed that his specimens proved that neither of these objections was valid. It having been asked if voltaic electricity had been found successful in removing the salts of lead from the sugar in Dr. Scoffern's process, Dr. Faraday expressed his opinion that it was impracticable. Professor De Vry thought the molasses would contain acetate of lime, which would be unfit for the uses to which it is put in Holland.

"On the Presence of Fluorine in the Waters of the Firth of Forth, the Firth of Clyde, and the German Ocean," by G. Wilson, M.D.—In 1846 the author announced the discovery to the Royal Society of Edinburgh of fluorine as a new element of sea water. He was led to search for it after observing that fluoride of calcium possesses a certain small but marked solubility in water, which explains its occurrence in springs and rivers, and necessitates its occasional, if not constant, presence in the sea. The only specimens of sea water he had examined before this summer were taken from the Firth of Forth, at Joppa, about three miles from Edinburgh. He obtained the mother-liquor or bittern from the pans of a salt-work there, and precipitated it by nitrate of baryta. The precipitate after being washed and dried was warmed with oil of vitriol in a lead basin, covered with waxed glass having designs on it. The latter were etched in two hours, as deeply as they could have been by fluor-spar treated in the same way, the lines being filled up with the white silica, separated from the glass. The author has recently examined in the same way bittern from the salt-works at Saltcoats, in the Firth of Clyde, but the indications of fluorine were much less distinct than in the waters on the east coast. On procuring, however, from the same place the hard crust which collects at the bottom and sides of the boilers used in the evaporation of sea water, he found no difficulty in detecting fluorine in the deposit. This crust or deposit consists in greater part of sulphate of lime, and of carbonate of lime and of magnesia, but it

contains, also, much chloride of sodium, and the other soluble salts of sea water, entangled in its substance. When sulphuric acid, accordingly, is poured on it, it gives off much hydrochloric and carbonic, as well as some hydrofluoric, acid, and the latter is thus swept away before it has time to corrode the glass deeply. The author preferred, nevertheless, to use the crust exactly as he got it, that the proof of the presence of fluorine might not be impaired in validity by the possibility of that substance being introduced by the water or reagents which must have been employed, had the chlorides and carbonates been separated from the crust by a preliminary process. The crust, accordingly, after being dried and powdered, was placed along with oil of vitriol in a lead basin covered by a waxed square of plate glass, with letters traced through the wax. A single charge of the crust and acid corroded the glass very slightly, but by replenishing the basin with successive quantities of these materials, whilst the same plate of engraved glass was used as the cover, he found no difficulty in etching the glass deeply. Operating in this way, he has found fluorine readily in the boiler deposit from the waters of the Firths of Forth and Clyde. It is a less easy matter to subject the waters of the open sea to the requisite concentration, before examination. It occurred to the author, however, that the incrustations which are periodically removed from the boilers of the ocean steamers would serve to determine the question whether fluorine is a general constituent of the sea He made application, accordingly, at Glasgow and Leith, for the deposits in question. It appears, however, that the deep-sea steamers which leave the former have their boilers cleaned out at other ports, so that he has as yet been unsuccessful in procuring crusts from the west coast of Scotland. He has obtained at Leith the crust from the boiler of a steamer called the Isabella Napier which trades between that port and Wick, so that the greater part of the water consumed as steam by its engines is derived from the German Ocean, although a portion is necessarily obtained from the Firth of Forth. The crust from the boilers of this vessel was treated in the way described, and at once yielded hydrofluoric acid. A single charge, indeed, of the materials marked the glass distinctly, and four charges deeply. We may, therfore, infer that fluorine is present in the waters of the German Ocean, for different portions of the deposit yielded it readily, and marked glass as deeply as the deposit from the water of the Firth of Forth did, which could not have been the case if the whole crust had not contained fluorine pretty equally diffused through it. From what is known of the comparative uniformity in composition of sea water, it may safely be inferred that if fluorine be present in the waters of the Firths of Forth and Clyde, and in the German Ocean, it will be found universally present in the sea. Mr. Middleton, before 1846, came to the conclusion that fluorine must be present in sea water, since it occurred, as he had ascertained, in the shells of marine mollusca. Silliman junior, without a knowledge of Middleton's views, drew the same inference from its invariable presence in the calcareous corals brought to America by the United States expedition from the Antarctic Seas. The author has found fluorine abundantly present in the teeth of the walrus, which points to its existence in the Arctic Ocean; and it seems so invariably to associate itself with phosphate of lime, that it may be expected to occur in the bones of all animals, marine and terrestrial. The author has found fluorine likewise in kelp from the Shetlands, but much less distinctly than he anticipated. Glass plates were only corroded so far as to show marks when breathed upon. Professor Voelker, also, was kind enough, at the author's request, to search for fluorine when analyzing the ashes of specimens of the sea pink (Statice armeria), which had grown close to the sea shore, and contained iodine, and found fluorine in the plant. When all those facts are considered, it is not too much, the author thinks, to urge that fluorine should now take its place among the acknowledged constituents of sea water. He has entered at length into the consideration of the natural distribution of this element, and into other details connected with it, in a paper in the "Transactions of the Royal Society of Edinburgh," vol. xvi., part 7, and in a communication made to the Association at its Southampton meeting. The Statice armeria may certainly be added to the list of plants containing fluorine, and so may the Cochlearia Anglica, in specimens of which obtained from the Bass Rock, and analyzed in Dr. Wilson's laboratory, Dr. Voelker has also detected this element.

Specimens of etched glass were shown to the section in illustration of this communication.

Professor Forchammer confirmed the results of Dr. Wilson. He had examined sea water from near Copenhagen, and found fluorine in every instance. He had also examined many shells and marine products from various localities, and they all gave the same body—the quantity of which was always greater in sea than in land animals. Mr Pearsall thought he had detected fluorine in many waters from springs and rivers.

"On Phosphorus as producing Cold Short Iron," by Mr. Rinman.—This was a statement of the discovery in the Swedish iron of phosphorus whenever it presented the peculiarity of being cold short, as it is technically termed. The process adopted was the following:—The pig-iron, weighing about three grammes and reduced to small pieces, was dissolved in diluted nitric acid, the solution evaporated to dryness, the dry mass heated strongly with free access of air in order to destroy all carbon. After heating, the dry mass was triturated and mingled with six times its weight of soda, a little chlorate of potass, and a little silica, and smelted as long as any gas was disengaged. The smelted mass was exhausted by boiling water, and digested for some hours. The solution was filtered, the undissolved residue washed with hot water, containing a small quantity of chloride of ammonium. The solution was evaporated to dryness, and the dry mass treated with hydrochloric acid and dissolved in water. After filtration the solution was neutralized, and the phosphate of lime was precipitated in a closed vessel by a solution of chloride of calcium with ammonia. This method is published more extensively by T. Akerman, professor in Fahlum.

Dr. Percy spoke of the importance of this inquiry — particularly in such a district as Birmingham. He then instanced many of the peculiarities of the Staffordshire iron which contain phosphorus; and spoke of the peculiarity of the Berlin iron, which is so singularly fluid in casting as being probably due to some such combination. Dr. Ronalds, Dr. Miller, and Mr. R. Phillips confirmed the fact of the general presence of phosphorus in east iron.

"On the Comparative Cost of Making various Voltaic Arrangements," by Mr. W. S Ward. The author stated that a series of calculations founded on data, produced to the Chemical Section at Swansea, showed the efficient power of three generally used forms of battery known as Smee's, Daniell's, and Grove's, would be equal when 100 pairs of Smee's, 55 pairs of Daniell's, or 34 pairs of Grove's were used, and that the expense of working such batteries, as regards a standard of 60 grains of zinc in each cell per hour, would be about 6d., 7½d., and 8d. respectively.

This communication led to conversations on the economy of the electric light and electro-magnetic engines, in which Dr. Faraday, Mr Shaw, Mr. Hunt, Mr. Elkington, and other gentlemen joined.—Dr. Faraday remarked on the imperfect character of the electric light, and its inapplicability for purposes of general illumination; all objects appearing dark when the eye was embarrassed by the intensity of the electric arc.—Mr. Shaw and Dr. Percy instanced the magneto-electric machines which are employed at Birmingham for electro-plating, in which the current cost of the motive power, viz., a steam-engine to put the magneto-electric machine in action, was the only working cost.—Mr. Elkington stated that they had never been induced to abandon the voltaic battery which they employed in their manufactory, finding it more economical than the magneto-electrical machine of which he was the patentee. He also stated the remarkable fact that a few drops of the sulphuret of carbon added to the cyanide of silver in the decomposing cell had the property of precipitating the silver perfectly bright, instead of being granulated so dead as it is when thrown down from the solutions ordinarily employed.

SECTION C.—GEOLOGY AND PHYSICAL GEOGRAPHY.

President—Sir C. Lyell, F.R.S.

Vice-Presidents—Sir H. T. de la Beche, Rev. A. Sedgwick, the Dean of Westminster, Mr. L. Horner, Sir R. I. Murchison.

Secretaries—Mr. J. B. Jukes, Prof. A. C. Ramsay, Prof. Oldham.

Committee—Prof. D. T. Ansted, Dr. Apjohn, Messrs. R. C. Austen, E. W. Binney, S. H. Blackwell, J. K. Blackwell, J. S. Bowerbank, Prof. Buckman, Lieut.-Gen. the Earl Cathcart, Dr. Daubeny, Prof. S. Forchammer, Messrs. J. Gray, R. Griffith, W. J. Hamilton, J. Hogg, W. Hopkins, R. Hutton, Captain James, Dr. Lloyd, Messrs. R. Mallett, W. Mathews, the Marquis of Northampton, the Lord Bishop of Oxford, Prof. Phillips, Messrs. H. E Strickland, J. Tennant, Dr. Wickenden.

"On the General Relations of the New Red Sandstone, the Coal Measures, and the Silurian Rocks of the South Staffordshire Coal-field," by J. B. Jukes.—The nature and position of the strata concealed beneath the new red sandstone is a matter of great practical importance as well as geological interest. The new red sandstone itself extends across England without interruption, ranging nearly north-east by south-west, whilst the coal measures and other older strata, possessing a higher economic value, are broken and irregular in their distribution. In the centre of England the new red sandstone expands into a great plain, on each side of which are several small detached coal-fields, and three others, appearing like islands, are entirely surrounded by it, namely, the coal-fields of Leicestershire, Warwickshire, and South Staffordshire. The inquiries of the author have been directed to ascertain whether these coal-fields are bounded by faults, in which case we might expect to find the coal beneath the whole extent of the new red sandstone plain,—or whether the boundaries of the coal measures are not rather to be considered as ancient cliffs and slopes caused by denudation, as in this alternative it will become probable that the coal measures were wholly, or in great part, destroyed, and removed from the intervals between the present fields before the deposition of the new red sandstone. The researches of Sir R Murchison, and more recently of the Geological Survey, have shown that the three groups of stratified rocks in South Staffordshire—namely, the new red sandstone, coal measures, and Silurian strata—are each unconformable to the other, because, although they have often nearly the same dip, yet the upper beds are found to rest on different portions of the lower strata at different localities. On the western side of the coal-field the Silurian strata, when apparent, consist of the Ludlow rocks, as at Sedgley and the Hayes; in the centre of the field the coal measures rest on the upper part of the Wenlock rocks, as at Dudley and the Wren's Nest; and further east, at Hay Head, a lower limestone appears, which is probably the equivalent of that at Woolhope. On the south of the district the coal measures rest on Silurian shale, and approach the quartz rock of the Lickey—the equivalent of the Caradoc sandstone. This unconformability indicates an uplifting of the Silurian rocks, and considerable denudation previous to the deposition of the coal measures. In the railway cutting near Dudley the horizontal coal shale and sandstone was seen abutting against a small cliff of Silurian rocks, and contained small quartz pebbles, making it look like an old beach.

The unconformability of the new red sandstones to the coal measures is of the same nature and owing to the same cause; at West Bromwich the upper coal measures below the new red sandstone are not more than 120 or 130 yards thick, whilst a mile off it is 190 yards where there is no new red sandstone; in other parts it is 200 and 300 feet thick, without any new red sandstone. The boundary of the coal-pit on the south-west is a great downcast joint, running from Walsall to West Bromwich and Oldbury, gradually increasing in amount to the south till it becomes 160 yards; this fault brings in the new red sandstone on the east, covering the coal measures, which are worked beneath it at several points; but the coal rests on Silurian shale, which, in more than one instance, has been found immediately beneath the new red sandstone, with no coal intervening. The western boundary of the coal-field is evidently at some points a fault with a very large downcast to the west. Along the southern boundary the coal and new red sandstone have scarcely any perceptible dip, and appear to be conformable; but there was probably an interval between their deposition, since pebbles of coal are found in the bottom beds of the new red sandstone. It thus appears:—1. That the Silurian rocks were upheaved and denuded before the deposition of the coal measures. 2. That there was a movement and denudation of the coal measures, amounting in some localities to their entire destruction and removal before the deposition of the new red sandstone. 3. That subsequently to the deposition of the new red sandstone there was a very great movement of all these rocks, producing their present faults and inclined positions. 4. That the boundaries of the South Staffordshire coal-field, as far as examined, present examples of three kinds of relation between the coal measures and new red sandstones, *i.e.*, by conformable succession; by fault, the coal measures being present on the downcast side; and thirdly, where the destruction of the coal measures has brought the new red sandstone into immediate contact with the Silurian strata. Whilst, however, there is great hope that the larger part of the new red sandstone plain conceals productive coal measures, there is no probability that these will be found at a depth of less than 500 or 600 yards below the surface.

Sir R. I. Murchison expressed his belief that at some future time the whole interval between Wolverhampton and Coalbrook Dale would be worked for coal.

"On the Igneous Rocks of the South Staffordshire Coal-field," by Mr. S. H. Blackwell.—The superficial extent of the igneous rocks in South Staffordshire was first described by Mr. Keir, in Shaw's history of the county; their underground developement by Mr. Arthur Aikin, afterwards by Mr. Yates, and again by Sir R. I. Murchison in the "Silurian System;" the progress of mining operations has continually added to the information respecting them. The trap rock, known to the miners of this district as the Green Rock, is most extensively exposed in the Rowley-hills, occupying an irregular area of about two miles in length, and a half a mile to a mile and a half in breadth; it also appears in small isolated masses at Netherton-hill, Barrow-hill, and Cooper's-bank, to the south of the Rowley-hills, and north of them, at the Heath Colliery, near Wolverhampton, the Neachells, the New Cross near Wednesfield, at Wednesfield itself, and at Pouk-hill, near Walsall. These scattered points of trap rock on the surface would give no idea of its subterranean extent, since it is met with at different depths from the surface, over a great portion of the Wolverhampton coal district. When sunk through by the coal-shafts it often appears to be interstratified with and conformable to the coal, and varies much in thickness and position; but as the workings in the coal have become more connected it has been ascertained that there exists only one continuous bed of underground trap which has been already traced from a point one mile north of the Rowley-hills to the Errington-brickyard, a distance of nine miles, with a maximum breadth of four miles between Wednesfield and the Birch-hills. The depth of this stratum beneath the surface, at the point nearest the Rowley-hills, amounts to 175 yards, and it becomes gradually deeper to the northward for 2¾ miles, where it is 234 yards deep; in this tract it is from 5 to 11 yards thick, and only from 5 to 11 yards above the junction of the coal with the Silurian strata. Further north it rises rapidly towards the surface, crossing the ironstone bands and coal strata, which it sometimes splits, and attaining a thickness of from 80 to 90 yards. At Wednesfield New Colliery it again descends to the depth of 17 yards, with a thickness of 44 yards; at New Cross it again rises to the surface, and continues so up to the fault which bounds the coal district. The variations in the thickness of the trap rock are due to the irregularities of its upper surface only, the under surface remaining level. The area of this underground stratum of trap as at present ascertained amounts to 25 square miles. The swellings of the upper surface of the trap, sometimes rising 60 or 70 yards, cause considerable irregularities in the ground above, which are still further increased and complicated by numerous small faults, locally "slip-things," which do not extend below the trap as the larger faults do; the upper surface of the trap also gives off numerous vertical dykes, which send off branches horizontally into the coal strata, there again subdividing into smaller veins of a white colour; these veins when first discovered often appear isolated, but, as the working proceeds, their connection with the subjacent dyke or stratum of trap is usually made apparent. To the south-west of the Rowley-hills four other subterranean beds of trap occur, whose connection with each other or with the Rowley trap has not yet been traced The rocks in contact with the trap are always more or less altered by it; and the change is always greater above the trap than below it; bituminous coal becomes anthracite, but the intervention of any thin shale has been sufficient to protect it. Ironstone is rendered black if in contact, green if separated by shale; the shales are indurated, the sandstones rendered quartzose and almost vitrified. The "green rock," or trap, itself is most compact in the Rowley-hills, and becomes coarser at a distance, especially in the "swellings" where crystals of mesotype and phrenite are common; it is darkest coloured in the central and thick beds, becoming lighter coloured and even white in the veins The second part of Mr. Blackwell's paper described the faults which traverse the South Staffordshire Coal field. This coal-field is bounded on the west and east by great lines of fault, beyond which the new red sandstone occupies the place of the coal. The downthrow of the great western fault has been ascertained in one place to amount to 300 yards. The centre of the field is crossed by the hills of Silurian rock at Sedgley, Wren's Nest, and Dudley, and by the trap rock of Rowley; to the north of this line the level and apparently unbroken surface is traversed by numerous east and west faults, some of which extend quite across the coal-field; nearer Rowley the faults range more north-east and south-west; and to the south of the Rowley-hills they are smaller and more irregular, but still somewhat north-east by south-west. The most northern of the large faults near Wolverhampton is a downthrow to the north of 120 yards in its central and deepest part; those which succeed are down throws to the south of 40, 70, 79, 130, and 50 yards respectively at the deepest part, coming towards either end, and often quite disappearing without reaching the boundary of the field; these are followed by the Dudley-port trough faults, the first a downcast to the south east of 30 yards, the second a rise to the same amount. The West Bromwich and Oldbury faults are downthrows to the east of 40 and 170 yards. On the southern part of the coal-field one great fault runs north-west and south-east parallel with the hills, and having a maximum downthrow to the west of 150 yards. Some of the smaller north-east and south-west faults extend from this line to the great western boundary fault, whilst others die out at shorter distances; some of them amount to 150 and 200 yards. In concluding, the author states:—1. That the transverse faults must have been produced subsequently to the boundary faults, and to the elevation of the Silurian hills. 2. That the direction of these faults is dependent on the central line of elevation. 3. That the great centre of this system is the Dudley-port trough. 4. That the underground trap of Wolverhampton proceeded from the Rowley-hills, and was injected prior to the formation of the east and west faults, which were probably caused by the withdrawal from beneath the coal strata of the great mass of igneous rocks in the Rowley-hills and Wolverhampton stratum; on the southern side of the field the downthrows of the coal are also greatest near the large central mass of trap.

Sir H. De la Beche and Mr. Jukes acknowledged the valuable service Mr. Blackwell had rendered to the geological survey by the use of his maps and sections.—Prof. Sedgwick remarked on the difficulty of accounting for the injection of such enormous masses of trap rock as were here described, or such as the Great Whinsill of the north of England, by any dynamical means. He also pointed out the difference between these beds, which had evidently been injected horizontally between the layers of strata already consolidated, and other instances in which (like lava-streams spread over the bed of the sea) the trap had been originally uncovered, but had become buried beneath gradually accumulating strata at the bottom of the sea.—Mr. Phillips attributed these and other similar systems of faults to movements of elevation and depression taking place subsequently and subordinately to other elevatory movements, by which lines and areas of greater and less resistance were formed. There was no necessity for supposing any sudden or violent action, but only a gradual change in the dimension of a given area in one direction.

A letter was read from Mr. I. Lea, the American conchologist, to the Dean of Westminster, "On the Discovery of Reptilian Foot-prints in the Old Red Sandstone, near Pottsville, Pennsylvania."—The foot-prints in question were discovered by Mr. Lea in the gorge of the Schuylkill, in the Sharp Mountain, near Pottsville, on a slab of sandstone, which is also ripple-marked, and impressed by rain-drops. They consist of six distinct impressions in a double row, each foot-mark being doubled, by the hind foot having fallen into the track of the fore foot, but rather in advance of it. The fore feet had five toes, three of which were apparently armed with claws; the length of each double impression is 4½ inches, its breadth 4 inches; the outside breadth of the double track is 8 inches; the length of the step 13 inches; the impression of the dragging of the tail is distinct, and occasionally obliterates part of the footsteps; the ripple-marks are 7 or 8 inches apart. The foot-marks are described as bearing a remarkable resemblance to those of the recent alligator, and also as somewhat like those of the chirotherium of the new red sandstone; but, as the animal was doubtless peculiar, Mr. Lea proposes to call it Sauropus primævus. The geological position of the foot-marked sandstone is about 8,500 feet below the upper part of the coal formation, in which Dr. King lately discovered the foot-prints of a reptilian quadruped in the western coal-field of America.

Sir C. Lyell stated that until a recent period no indications of air-breathing animals more highly organized than insects were known below the Permian system. Dr. Goldfuss had, however, discovered the skeletons of two reptiles in the coal strata near Trèves; and he was disposed to consider the rock described by Mr. Lea as really belonging to the old red sandstone.

SECTION D.—NATURAL HISTORY, INCLUDING PHYSIOLOGY..

President—Mr. W. Spence.

Vice-Presidents—Messrs. J. Hodgson, J. G. Jeffreys, Professor W. H. Acland, Dr. Roget,

Mr. C. C. Babington, Dr. W. P. Alison, Dr R. Fowler, and Professor E. F. Forbes.

Secretaries—Dr. Lankaster, Dr. Russell.

Committee—The Bishop of Oxford, Professor Knowles, Dr. Palmer, Professor W. S. Cox, Professor Wescott, Messrs. J. Hogg, J. S. Bowerbank, R. Taylor, B. Maund, C. W. Peach, Professor Milne-Edwards, C. L. Bonaparte (Prince of Canino), Messrs. A. Strickland, W. Clear, J. E. Winterbottom, Professor Daubeny, Messrs. H. E. Strickland, R. Austin, Dr. Groshaus, Dr. Boogaard, Dr. Macdonald, Professor Allman, Dr. G. Lloyd, Messrs. J. W. Gutch, R. Ball, and A. Henfrey.

The business was commenced by Professor Daubeny, who read a report "On the Action of Carbonic Acid on Plants Allied to the Fossil Remains Found in the Coal Formation."—The apparatus used in these experiments was so constructed that a constant supply of carbonic acid could be kept up, so that plants or animals exposed in it were constantly subjected to the same quantities. The results of the experiments were, first, that quantities of carbonic acid, not exceeding five per cent., did not appear to affect injuriously species of ferns or pelargonium; second, a quantity amounting to twenty per cent. injured plants exposed to it; third, the quantity of oxygen given out by plants was not found to be increased by the quantity of carbonic acid to which they were exposed; fourth, on exposing animals to the action of carbonic acid it was found that frogs and many fish could live in an atmosphere charged with five per cent. of carbonic acid. From these experiments he concluded that no objection could be offered to the theory of a large proportion of carbonic acid having existed in the atmosphere in the early periods of the world's history.

Mr. Austin did not think the theory, broached by M. Brongniart, of the large quantity of carbonic acid in the early atmosphere of the earth tenable nor necessary to the explanation of the phenomenon of the great vegetation of the coal period. It was not even now well determined whether the principal part of that vegetation consisted of ferns. From his own experience in the growth of ferns he had found that the soil in which they were placed greatly modified their growth. He did not think the temperature of Great Britain much changed since the coal period. Few of the ferns found in the coal possessed any fructification, whilst those in more southern beds presented it. This agreed with his own experiments, in which he found that the ferns of tropical climates would not fructify at a low temperature.—Professor Milne-Edwards said that the theory which explained the deposition of the mountain limestone by the chalk held in solution by carbonic acid was opposed to the fact that zoophytes generally soon died when the water in which they were kept was tainted with carbonic acid. He hoped Dr. Daubeny would extend his researches.

"Observations and Experiments on the Noctiluca Miliaris, the Animalcular Source of the Phosphorescence of the British Seas, together with a few General Remarks on the Phenomena of Vital Phosphorescence," by Dr. Pring.—After reciting various observations by others on the phosphorescence of animals, the author detailed his own experiments at Weston-super-Mare upon a small vesicular animal, not more than one thousandth part of an inch in diameter, which possessed very remarkable luminous properties. This animal the author believed to be the Noctiluca miliaris. It occurred sometimes in so large quantities and was so luminous as to give the sea the appearance of a sheet of fire. After detailing its structure, the author gave the results of experiments upon the light emitted. Galvanism increased the luminosity; oxygen gas and carbonic acid gas also increased the light, but the latter most speedily killed the animal; sulphuretted hydrogen quickly destroyed the light; nitrogen, nitrous oxide, and hydrogen produced little or no effect on the luminosity; strong mineral acids increased for a moment but speedily afterwards destroyed the light; ether instantly destroyed the life of the animal; chloroform increased the light and then destroyed the animal. The author then instituted a comparison between his own experiments and those of Professor Matteucci on the glowworm; and, after examining the various theories put forward to account for the luminosity of animals, concluded that the phenomena could not at present be referred to any more general fact with which we are acquainted.

Mr. R. Taylor referred to Ehrenberg's papers and to his opinion that the luminosity of animals depended on electricity.—Professor M. Edwards referred to facts which could not be explained either on the supposition of the cause being electricity, phosphorescence, or combustion.—Sir E. Belcher related a number of facts with regard to the phosphorescence of the ocean, and expressed his conviction that it was not a living process.

A letter was read from Mrs. Whitby:—

"Birmingham (Newlands).

"I had proposed offering to the British Association a short account of my progress in the art of cultivating silk in England; but I left Newlands before all the produce of this year could be wound off from the cocoon; and it will not, therefore, be in my power to make my report as full, or as statistical, as I could desire. I am, however, unwilling that this meeting should pass without endeavouring in some way to satisfy the expectations of those who have been sufficiently liberal to pay regard to my convictions that the cultivation of silk may with little trouble or expense be made general, and in the end become a profitable speculation. From the period when I had the honour to place before you an account of my early trials, I have paid attention to the cultivation of the mulberry, especially of that species which I introduced in 1846, viz, the Morus multicaulis of the Philippine Islands. I have three other kinds of white mulberry, which all grow well at Newlands; but as none are so easily propagated as the multicaulis, or bear so great a weight of leaf, I have increased my plantation with them chiefly. I said, in my letter to the Royal Agricultural Society in 1844, that it was as easy to do so as to propagate the willow. I now say that it is much easier, and the produce is more abundant. The produce of leaf this year has been immense; and even now, after having plucked them closely to feed my silkworms, they are strong and vigorous, and present a luxuriance of growth scarcely to be credited—unseen. I find the cuttings which are rooted in the open ground produce stronger and healthier plants than those struck under glass. One of my early pupils has a productive nursery at Godalming of the Morus alba—many others in different parts of England are planting; and, if gentlemen in England and Ireland who have a few acres or roods of land to spare would plant mulberries for posterity as they do their oaks, we should in a few years be independent of other countries for our supply of raw silk. With regard to the rearing of the silkworm, as their habits become more practically known to me, I find less and less difficulty in bringing them to perfection, and am confirmed in my belief that, with due attention to their peculiarities, they may be reared in England as easily as in any other country, and with as little loss by death. Equable warmth throughout the period of their existence (which may be shortened or prolonged at pleasure), cleanliness, classification, and ventilation, with the adaptation of the food (as to its maturity) to the different ages of the insect, will ensure success. I have been this season very successful in rearing the worms I was able to hatch; they had no disease of any kind; they made their cocoon in thirty days, and the silk I have been able to wind off is as strong, and bright, and beautiful, as that which, in 1844 and 1845, was pronounced superior to the best Italian raw silk. There are many persons in England, and a few in Ireland, who have begun the experiment on a small scale. It requires time to mature and perfect any undertaking; but, if I live long enough, and the growth of the mulberry becomes generally encouraged, I have no doubt my ardent wish to see the cultivation of silk established in England will be realized.

"M. S. S. Whitby."

Dr. Paxton read a paper "On Pathological Drawings," and exhibited a series of illustrations of disease.

Section G.*—Mechanical Science.

President—Mr. R. Stephenson, M.P.

Vice-Presidents—Messrs. W. Blake, W. Fairbairn, F. Osler, T. Webster.

Secretaries—Messrs. W. P. Marshall, C. Manby.

Committee—Messrs. J. G. Appold, W. Baker, R. Davison, C. Fox, J. Henderson, E. Hodgkinson, Rev. S King, Messrs. J. G. M'Connell, R. Martineau, G. Nasmyth, R. S. Newall, R. Roberts, J. Taylor, F. Whishaw.

"On a Method of Supplying the Boilers of Steam-engines with Water," by Mr. W. S. Ward. Mr. Ward's suggestion was to use a small supplementary pumping-engine, having a working cylinder with valves so arranged that the piston may be put in motion by either steam or water passing through it, to be supplied with steam, by a steam-pipe, the entrance to which is somewhat narrow, and inserted in the boiler to be supplied a little above the level at which it is desired to maintain the water therein. Such aperture should also be about the centre of a marine boiler. The working cylinder should be attached to a pump of such size as to be easily worked by the pressure of the steam. The exit-pipe of the steam cylinder must communicate with the inlet-pipe of the pump, so that, if the cylinder be actuated by steam, the steam will be condensed, and its heat communicated to the water to be supplied to the boiler; or, if the working cylinder be worked by water proceeding from the boiler, a considerable part of such hot water will be returned by the pump. The mode of operation of such apparatus will be, that whenever there is a working pressure of steam in the boiler the apparatus will be in action; but, if the level of the water be below the aperture of the small steam-pipe, the action will be moderately rapid, and a supply of water be pumped into the boiler; and, when the water in the boiler rises to the aperture, this, being small, will be as though choked by the water, which will be forced through the working cylinder, moving the piston and pump very slowly; a portion of the water thus escaping from the boiler will be returned by the pump. Such last-mentioned action cannot continue long, inasmuch as the level of the water must be reduced; therefore the average level of the water in the boiler will be, with slight oscillations, maintained at the height of the supply-pipe.

In the course of a brief discussion which followed, the president said that it was a new and ingenious idea, but one which he was afraid was not practically useful.

A "Description of a Patent Tide-winding Apparatus" was read by Mr R. Roberts.

A "Description of the Excentric Sheet-Metal and Wire Gauge" was read by Mr. R. Roberts.

"On the Britannia bridge."—The President (Mr. R. Stephenson, M.P.) gave an interesting sketch of the causes which produced the late accident; and of the difficulties which have stood in the way of finally completing the work.

"On Chain Pipes for Sub-Aqueous Telegraphs," by Mr. Whishaw.—Three links of a full-sized pipe for enclosing the wires of electric telegraphs in crossing rivers, &c., were laid before the section. As the title implies, the pipe is formed by so many links connected together by sockets—each link varies according to circumstances from 18 inches to 24 inches in length, and from 1 inch to 2½ inches internal diameter, according to the number of wires to be enclosed. These pipes being of wrought iron are exceedingly strong, and are required merely as a protection to the wires, which are previously insulated by means of gutta percha. Pipes of somewhat similar construction are laid under the Rhine and other rivers in Prussia—where the

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* We omit Section F.—Statistics.

underground system of telegraphs is adopted by the Prussian Government (already to the extent of 1,200 miles)—although many of the railway companies suspend the wires between posts, as practised in England, America, France, &c.—The discussion which followed was brief; its purport was generally to signify approbation of the invention.

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THE CHEMICAL TIMES.

SATURDAY, SEPTEMBER 22, 1849.

DECLINE OF THE CHOLERA.

THE prediction on which we ventured last week has been realized sooner than we dared to anticipate. The cholera has during the last ten days considerably abated in virulence, and there is now every reason to hope that this fearful malady will speedily leave the metropolis. The confident anticipation of this happy relief from one of the direst scourges that ever visited the land is unquestionably a reason for congratulation; but we must most decidedly protest against the pæans of triumph which the Board of Health and the medical profession seem but too much inclined to chant in their own praise. We fearlessly continue to affirm that neither the "measures" of the one, nor the "skill and experience" of the other, have tended, even in the slightest degree, to check the ravages of the cholera; and that that fearful disease is now taking its departure simply because the conditions which gave rise to it and maintained it have ceased to exist. But our knowledge of its origin, generating causes, nature, and proper treatment, remains exactly in the same most unsatisfactory position as in 1832, when it first visited our shores. *Not a single new fact* has been added to our very slender stock of knowledge of this mysterious distemper; and the only tangible result which the medical profession seem to have arrived at appears to be a strong asseveration, elevated to the dignity of an axiom, that the cholera is readily curable *before* it declares itself—which, properly interpreted, simply means that *diarrhœa* and the other (assumed) *premonitory* symptoms are curable, but that cholera is not; which leaves us exactly where we were. It may be a very convenient thing for physicians and surgeons to declare in cases of mishap that they have been called in "too late;" and, indeed, this plea may be excused in men in the peculiar and delicate position in which medical practitioners find themselves placed. But we cannot subscribe to the fulsome *praises* bestowed upon the profession by the Registrar-General (or rather by Mr. Farre) in his return of last week. To assert that no city ever possessed such an *efficient* body of medical men as are now practising in London is almost too ridiculous an absurdity to deserve the trouble of refutation; and to state that the said body of men "have combated the disease night and day in the most pestilential quarters, and that *on much more settled principles* than the public might be led to suspect from certain discussions at the medical societies," is, in our opinion, and, as we trust, must be in that of every right-thinking individual who will not allow himself to be "*bamboozled*" by "official returns and reports," but will look for *correct* information solely to "*facts* and *figures*," a positive and, let us add, *wilful* misstatement. May we be permitted to ask the Registrar-General to point out to us even the *shadow of a settled principle* that has obtained lately in the treatment of the cholera in the metropolis? How is it even possible to talk about the treatment of a disease upon any principle whatsoever (except upon that of the wildest empiricism which, we will most willingly grant, has *universally* obtained in London during this visitation), as long as the origin, generating causes, and nature of that disease remain unknown? Verily, we should not wonder to see the Registrar-General assert in his next week's return that the Board of Health and the medical profession have put the cholera to flight, and that the country owes to these bodies an eternal debt of gratitude!

THE HEALTH OF LONDON DURING THE WEEK.

[From the Registrar-General's Report.]

The deaths registered in London in the week ending Saturday, September 15, were 2,865, of which 1,682 were by cholera, making the aggregate numbers, since the commencement of the epidemic in London, 12,837. The deaths from all causes in the last six consecutive weeks were 1,909, 2,230, 2 456, 2,796 3.183, 2,865. The numbers last week sensibly decreased. On Sunday the inhabitants of these islands, in the city and the country, in their cathedrals, village churches, and chapels, assembled to entreat God to stay the destroying plague; and, as if by anticipation, it began to subside, so that the time was most appropriate. After they had been journeying through the gloom, while the darkness grew thicker, the terror greater, the strokes of mortality nearer and everywhere uncertain, the light began to dawn, and the prayer—half supplication, half thanksgiving—rose of itself from the hearts of the people.

These great acts of religion are rarely performed in England; and, whether the earnestness of the nation or the truth of God is regarded, the prayer for health has a much more serious import here than the ceremonial rites of paganism in Persia, Greece, or Rome; yet there it would have been deemed impiety to ask the increase or the earlier and later rains unless the land were tilled and the seed sown; or to implore victory for their arms except through the valour of well-equipped armies. The prayer for the public health in England is a solemn pledge, not only that all the powers of the state, but that the local authorities, the clergy, the educated classes, who form and govern opinion—all the multitudes who join in that prayer—will employ the means which, with God's blessing, will ensure its accomplishment, and save the people from the ravages of the cholera and other epidemics.

Thousands of the houses of London have now no pure water; in some places where the cholera is most fatal the inhabitants are driven to use polluted waters of tidal sewers for culinary and household purposes. This state of things will exist no longer; the first engineers of the country will be employed to lay the rivers under contribution, and in every house there will be a spring of fresh, filtered, living water; for circulating water is the life-blood of a city.

The bodies of the dead, "sown in corruption," will be decently interred in distant grounds and sacred groves, where their flesh may be resolved into its elements without tainting the air and destroying their brothers.

The carnage of slaughtered animals will no longer be suffered to infect the air of cities.

The sinks and sewers of London — black bubbling lakes and rivers under ground—extending from the Thames to the house drains and cesspools, send up damps into dwellings nightly, travel by us in the streets daily, and through a thousand mouths by the way and river side pour their poisonous incense on the passengers for ever: these emanations, if not drawn through and decomposed by fire, will no longer open under our faces, but ascend with the smoke over the houses; and other matters be carried, solid or in streams of water, over distant fields.

No city, perhaps, ever possessed such an efficient body of medical men as are now practising in London. During this epidemic they have performed services which in any other field must have won the highest honours; combating the disease night and day in the most pestilential quarters, and that on much more settled principles than the public might be led to suspect from certain discussions at the medical societies. And their office has been discharged with so much kindness as to deserve the gratitude of the poor, instead of drawing down on their heads the charges with which the physicians of other countries have often been assailed by the populace. Nearly all the sick have been seen by these practitioners, yet 12,837 persons have already died of cholera in London. How is this? The medical force will be found to have been employed at an immense disadvantage. It is called into action at the wrong end of the malady. Inquiries prove that, while medical advice is generally sought in the characteristic stage, it is seldom obtained in the premonitory stage, when the power of medicine is decisive; and to that earlier and still more important period preceding the premonitory stage, which is prevented as easily as cured, medical practice has had little or nothing to say. Cholera here also only shows in high relief what exists in ordinary circumstances. Medical men rarely if ever treat the beginnings of diseases, and are scarcely ever consulted professionally on the preservation of the health of cities or families. The art of preserving health is taught in no regular course of lectures at any of the great schools of medicine in the United Kingdom. Yet the classical sanitary works of Pringle, Lind, Blane, Jackson, Johnson, and Martin, have been framed from observation in the British navy and army. In the science of health there are more exact demonstrable truths than in the science of disease; and the advantage of "prevention" over "cure" requires no proof. In the "Cyropædia" of Xenophon physicians who only treat the sick are compared to "menders of torn clothes," while the preservation of health is declared a noble art, worthy of Cyrus himself. Vegetius speaks in similar, Jackson in stronger, terms, but, perhaps, unjustly; for if it is godlike to save many from suffering, and to carry them in healthy life up to the natural term of existence, it is a worthy occupation to rescue a few from the arms of death or incurable infirmity. But the preservation and restoration of health are parts of one science; and if, as has been done by London and Liverpool, health officers be appointed in all the districts of the kingdom, the art of preserving health will be studied by a high order of men, well paid by the public; and ultimately with an increase of their remuneration—the diminution of sickness, the disappearance of epidemics, immense advantage to the public—the whole medical profession may devote themselves to the preservation and development of the vigour of the human faculties, instead of being tied down to the treatment of the sick and dying. "And this," Lord Bacon

says, after his great survey of learning, "we hope might redound to a general good, if physicians would but exert themselves and raise their minds above the sordid considerations of cure; not deriving their honour from the necessities of mankind, but becoming ministers of Divine power and goodness, both in prolonging and restoring the life of man; especially as this may be effected by safe, commodious, and not ill beral means, though hitherto unattempted. And certainly it would be an earnest of Divine favour if, while we are journeying to the land of promise, our garments, those frail bodies of ours, were not greatly to wear out in the wilderness of this world."—*Hist. Vitæ et Mortis.*

STATEMENT IN CONTINUATION OF THE ONE PUBLISHED IN THE CHEMICAL TIMES OF SEPT. 15, 1849, SHOWING THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE AIR FROM SEPT. 9 TO SEPT. 15 INCLUSIVE, AS INDICATED BY THE EVAPORATION OF WATER FROM TWO COPPER VESSELS OR SCALES, ONE INSULATED AND THE OTHER NOT. ALSO THE READING OF THE BAROMETER, THERMOMETER, DIRECTION OF WIND, AND GENERAL STATE OF THE WEATHER.

Sept., 1849.	Barometer.		Therm.		Scales.				Wind.		General State of Weather.
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Insulated	Non-Insulated	Morning.	Evening.	
9	29.88	29 65	60	59	..	5 I.	5	..	SW.	SW.	Fine all day.
10	29.48	29.30	63	61	5 I.	..	5	..	SW.	SW.	Fine morning, cloudy afternoon, and heavy rain evening; evaporation sluggish.
11	29.18	29.10	59	55	..	..	..	..	SW.	SW.	Ditto - - - ditto - - - slight thunder shower evening; evaporation sluggish.
12	29.05	29 10	53	52	5 I.	..	5	..	SW.	NW.	Heavy rain with short intermissions all day.
13	29.45	29.95	56	54	5 I.	..	5	..	NW.	NW.	Heavy rain about two A.M.; generally cloudy and rain throughout the day.
14	30.10	30.15	57	59	10 I.	..	10	..	NW.	NW.	Generally cloudy all day, but no rain.
15	30.17	30.15	60	58	5 I.	..	5	..	SW.	SW.	Generally fine all day.

Crystallization being referable to electricity, the formation, in the upper regions, of a crystalline body, such as snow, must obviously abstract from some locality a certain amount of that fluid; and, *when* my scales shall be registered as an instrument of scientific research, it will be found that an excess of evaporation from the non-insulated vessel is generally either attended with, or followed by, wet weather,—a fact that naturally induces the conclusion that the atmosphere in which we move parts more readily than the earth on which we stand with any amount of electricity it may possess, beyond that which is necessary for the *chemical* combination of its elements. Burnt coffee, when whole, occupies more space than when ground, and during disintegration throws the mill into a high electrical condition, so much so that those particles which come in contact with the discharging nozle drop only, *as was observed to me by my grocer's apprentice*, when the electrical state is restored; and the increase of weight acquired in the grinding corresponds with the decrease of space occupied: 2½ lbs. increased in grinding ¼ oz., and acquired a further weight of ¼ oz. during the night in a perfectly dry atmosphere, and packed in a brown paper bag; but did not further increase throughout the day. In the evening it was packed in a tin canister, and left under the pressure of a lever during the night. On the following morning the total increase was 1 oz., one half of which increase in weight departed when the coffee was again restored to its uncompressed form in the bag, being precisely the weight acquired by compression! Electricity is, then, the bond of union in matter, and *weight* can be nothing more than the indication of the electrical force with which a positive or negative electrical body is either drawn towards, or repelled from, the intensely negative centre of the earth. See papers addressed to the Board of Health, and published in the *Chemical Times* of the 16th of June last, "On the Electrical Condition of the Human Frame in Reference to Epidemic and other Diseases."

Westminster-road, Sept. 18, 1849.

Franklin Coxworthy, Author of "Electrical Condition," &c.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Hugh Lee Pattinson, for improvements in manufacturing certain compounds of lead. Patent dated February 14th, 1849. Enrolled August 14th, 1849.

The patentee commences his specification by stating that he has discovered that when ½ an equivalent or thereabouts of lime, soda, potash, ammonia, or barytes is added to 1 equiv. of chloride of lead, both in solution, the whole of the lead is precipitated as a definite compound of 1 atom of chloride of lead and 1 atom of hydrated oxide of lead, which, when dried at 212° F. or under, has the composition just stated, or $PbCl + PbO,HO$; but when dried at a temperature varying from 212° to 350° it loses more or less of the atom of water, and becomes or approaches to $PbC + PbO$. If less than ½ an equiv. of the alkaline precipitant is employed, the same definite oxychloride of lead is precipitated, but some of the chloride of lead remains in solution. The oxychloride of lead thus produced possesses a brilliant white colour and great "body" qualities, which render it an excellent pigment and useful for most purposes to which white lead is applicable.

The invention consists in the manufacture and application of this oxychloride of lead, or such other compounds of oxide of lead and chloride of lead as shall result from the following mode of manufacture:—The patentee states that lime will answer as well for the purposes of this invention as any of the other alkaline precipitants above named, and he prefers to use it on account of its cheapness. He first makes a saturated lime-water, by throwing an excess of slaked lime into a tub, filling the tub with water, and allowing it to stand until it becomes clear. The clear liquor will contain in from 770 to 780 parts 1 part of lime; and therefore 1 cubic foot of it will contain 567 or 568 grs. of lime. A solution of chloride of lead is then made by dissolving it in boiling water, in the proportion of 1lb. of pure chloride of lead to 1⅕ cubic foot of water. As some water contains earthy salts (sulphates or carbonates, or both) which precipitate lead, the patentee prefers to use such an excess of chloride of lead as will compensate for this loss. The solution is prepared by introducing the chloride of lead and boiling water into a wooden barrel, provided with a revolving agitator, and then it is run into cisterns to settle. The clear solution of chloride of lead is mixed while still warm (because if allowed to become cool it would deposit some of the chloride of lead) with an equal bulk of the lime-water; on this taking place, the insoluble oxychloride of lead is immediately formed, and speedily settles to the bottom of the cistern, leaving a clear supernatant liquor (a weak solution of chloride of calcium); and after this liquor is drawn off the precipitate is collected and dried.

As the operation of mixing the lime-water and the solution of chloride of lead requires to be performed in an instantaneous manner, the patentee prefers to employ for this purpose two tumbling-boxes, of about sixteen cubic feet capacity, which are charged with the two liquids, and simultaneously upset into a cistern, in which the oxychloride of lead is instantaneously formed, and from which the mixture flows into other cisterns, where the oxychloride subsides.

The patentee states, that a though he has only mentioned pure crystallized chloride of lead in the description of the process, yet it is not absolutely necessary that it should be in this form; for a rough chloride, made from lead ore and its equivalent of muriatic acid, boiled to dryness, will answer, provided it be well washed, to free it from chlorides of iron, manganese, or other bodies likely to injure the colour of the oxychloride. The exact proportions of pure chloride contained in the rough chloride should be ascertained previous to use, in order that the proper quantity may be mixed with the lime-water. If, however, a solution of chloride of lead, of uncertain strength, is obtained, or lime-water not quite saturated, they can be used with but little disadvantage; for it is only necessary to be careful not to add an excess of lime (*i.e.*, not more than the half equivalent), which can be easily ascertained after a few trials, by filling the lime or lead tumbling-box more or less with its respective solution, as the trials may direct.

The patentee says that it will not be necessary to describe any particular mode of proceeding with soda, potash, ammonia, or barytes; for, if ever it should happen that these bodies could be used in preference to lime, it would be merely necessary to make a solution of each of known strength, and to use it with chloride of lead in the same manner as the lime-water.

Jean Adolphe Carteron, of Paris, in the Republic of France, for certain improvements in dyeing. Patent dated February 5th, 1849. Enrolled August 5th, 1849.

These improvements in dyeing consist in the preparation of certain mordants, to be used instead of the cream of tartar and cream of tartar and alum now commonly employed, whereby colours will be produced at less cost than heretofore, and of superior brilliancy and variety.

The mordants are four in number. The first is prepared by dissolving 18 parts by weight of common salt and 9 parts of tartaric acid in 67

parts of boiling water, and then adding 18 parts of the acetic acid of commerce. One pound of this mordant is equivalent for dyeing purposes to about one pound of cream of tartar, and it is used in the same manner. It is suitable for crimson and all reddish dyes.

The second mordant is made by triturating and mixing 1 part of alum with 2 parts of the residuum (sulphate of soda) of that mode of manufacturing nitric acid in which nitrate of soda is employed. $2\frac{1}{4}$ lbs. of this mordant are equivalent to half that quantity of cream of tartar, and it is to be used in the same way. It is suitable for all olive and brown dyes.

The third mordant is prepared by triturating and mixing together 5 parts of common salt and 1 part of the residuum of the manufacture of sulphuric acid where nitrate of potash is employed. This mordant is to be used in the same proportions to cream of tartar as the second mordant, and it is applicable to black and dark colours only.

The fourth mordant is formed by dissolving 6 parts of sulphate of alumina, 3 parts of nitric acid, and 1 part of caustic ley of 24° Beaumé in 20 parts of boiling water. It may be used in dyers' baths for green dyes of all shades and fancy dyes, in the proportion of 1 pint for every 20 lbs. weight of the fabrics to be dyed.

Henry Crossley, of the firm of Henry Crossley, Son, and Galsworthy, of Emerson street, Surrey, engineers and coppersmiths, for certain improved modes or methods of apparatus for heating and lighting, for drying substances, and for employing air in a warm and cold state for manufacturing purposes. Patent dated February 28th, 1849. Enrolled August 28th, 1849.

This invention relates, first, to improvements in boilers for heating water, or generating steam, by which a greater amount of heating surface is obtained than in the ordinary cylindrical boilers. This improved boiler consists of two cylinders placed in a parallel position, one above the other, and connected by semi-circular ends, which for illustration may be compared to the link of a chain. This is set in brickwork, in the ordinary manner of setting boilers, with the furnace immediately below the lowest section of the boiler; the flues are then conducted somewhat in the usual manner round the boiler at about half its height, and so as to form a communication with the space between the halves of the boiler which is entirely devoted to flue space; this extends throughout the semi-diameter of the upper and under portions, thereby presenting a greater amount of heating surface. Connecting pipes are placed between the two cylinders to admit of a free circulation of the water and the escape of the steam to the upper portion, and thence to the steam-chest on the top. The backward flue is carried over the top, and thence to the chimney.

The second part refers to the construction of boiler and other furnaces, by which a more perfect combustion of the fuel is ensured; this consists in placing two, three, or more rows of pillars immediately behind the bridge, extending nearly up to the bottom of the boilers, and each row so placed (with regard to that behind it) that the products of combustion shall, on coming in contact with the first row, be deflected, and caused to come in contact with the pillars of the next row, and so on, which causes the gases to commingle, and thereby ensures their more perfect combustion. To this construction he has given the name of "Ronald."

In connection with this he has introduced passages leading from the top of the brickwork to below the fire-bars, by which the air becomes slightly heated before entering the fire.

The third part has reference to the generating steam of a low pressure by the employment of high-pressure steam, which the patentee considers extremely applicable to marine purposes, as fewer fires are required. The boiler, constructed on this principle, consists of an ordinary flue-boiler, in which high-pressure steam is generated. This is conducted through, and caused to circulate in, a worm pipe or pipes in other vessels, constituting the low-pressure boilers; the high-pressure steam being condensed by the contact of the worm with the water, thereby generating steam at a lower pressure. The worm-pipe terminates in a box, having a valve placed therein, by which the condensed water escapes, and returns to the high pressure boiler.

The fourth part refers to the heating sugar-pans, which, according to the ordinary method, is effected by means of a fire under the smallest pan, usually denominated the "teache;" the flue from thence passing under the other pans of the set. Now, considerable injury results in the evaporation of the syrup, both when it is being charged into, and removed from, the pan, from the small quantity remaining therein during some part of the time; to obviate which the patentee places the furnace on a wheeled carriage, and adapts both of the first pans for the direct application of the fire-heat. When it is desired to recharge the first pan, the furnace is wheeled back under the second pan during such operation; when this is effected, the furnace is withdrawn to its original position, by which the evaporation in the other pans is interrupted, at the same time obviating the injurious results in the teache. The furnace-carriage has a horizontal plate at the back part, of the width of the recess in the brickwork, for the reception of the carriage. This plate—when the carriage is pushed backwards under the second pan—enters a recess in the brickwork; and, when the carriage is under the teache, it forms a continuation of the flue under the second pan, and divides it from the cavity left in the brickwork for the carriage. For effecting the more easy movement of the carriage, rails may be placed as a running surface.

The fifth part has reference to an improved gas-heating stove, which the patentee terms the "Ronald." The improvement consists in carrying the heated atmosphere produced by a gas-stove into a chamber or case placed in the apartment it is desired to heat. This chamber is formed so as to expose a great extent of external heating surface, and is subdivided by numerous partitions, by which the heated atmosphere is caused to traverse backwards and forwards, and to impinge on the outer case, thereby giving off the entire heat before escaping from the chamber, the vapour being conveyed into the chimney, or otherwise conducted away.

The sixth part consists of a gas-exhausting apparatus, for the exhaustion of gas from the retorts, and its transmission into the purifying apparatus, or into the gas-holder, by which it is unnecessary to create such pressure in the retort. This apparatus, in its general construction, resembles very much the ordinary gas-holder, being an inverted vessel placed in another vessel containing water, and having two pipes (or it may be a third chamber divided into two parts), which form the inlet and outlet passages for the gas, one being connected with the retorts, and the other with the vessel into which the gas is to be transmitted. Suitable valves are placed in these pipes, so as to permit the flow of gas in the proper direction. To the inverted vessel a reciprocating motion is given by means of a rack, stem, and pinion, working therein, the upward motion of the vessel exhausting the gas from the retorts, while the downward stroke transmits it to its destination. The lower ends of the inlet and outlet pipes terminate or depend in a chamber, for the purpose of closing them, by the introduction of water thereto, for the purpose of preventing the flow of gas, by the pressure generated in the retorts, when the apparatus remains stationary. A stopcock is provided at bottom, to admit of the escape of the water when required. An inverted vessel is placed in connection with the escape-pipe of the gas, which is so balanced that the gas, when not at a medium pressure, raises it to a certain point, so that two valves in the inlet and outlet pipes, with which it is in connection, shall be allowed to remain half open, at the same time affording sufficient passage for the gas; but on any increase of the pressure taking place in the retorts it will be raised still higher, and the valves thereby closed farther; and on a decrease taking place an opposite effect will result, thereby regulating the quantity passed through the exhauster. This apparatus may also be employed as a measure or meter for gas, by applying a counting or telling apparatus to register the number of movements of the inverted vessel; the known capacity of which being registered on dials by a train of wheels, in the ordinary manner of registering gas and other like fluids.

The seventh part refers to other forms of gas-exhausters, which consist simply of a rotary wheel, or set of arms in connection with a hollow axis, through which the gas is drawn by means of the centrifugal force produced by the rotary motion imparted to the wheel. In its construction it is very similar to the simple emission rotary engine. The gas that escapes from the orifices of the arms is collected in an outer casing, from which it is conveyed to the purifier or other holder. Instead of having hollow arms, the wheel may consist of two discs, between which are separating blades or partitions, passing from the centre to the circumference in a volute direction, and between which the gas issues when rotary motion is given to the wheel. Other modifications are given of this exhauster, which have a similar principle of action.

The eighth part has reference to a coal fire-stove, by which the heat may be caused to radiate in any direction, or to any part of an apartment; this consists in setting the grate, or that part of the grate in which the coals are placed, on a single stem, which turns round in a socket, or it may be on a ball-and-socket joint, by which the front of the fire may be presented in any direction. This stove or grate is placed in the centre of a hollow reflector, by which the entire heat is reflected in one direction; the reflector or shield being attached to the grate partakes of the same movement as the grate, which always retains its central position with reference to the reflector. To this stove he has given the name of the "Garrow."

The ninth part relates to a divergent gas-stove, of a somewhat similar construction, by which the light and heat are reflected to any point of an apartment, by a similar hollow reflector, in the centre of which the gas-burners are placed, in the position of a stove, the reflector and burners being moveable on a ball-and-socket joint, as before described, which is adjusted to reflect the light and heat resulting from the combustion of gas; the light and heat so reflected may be caused to impinge on other reflectors in the ceiling of an apartment, by which it may be again reflected in a downward direction, as being more applicable for the diffusion of light. Other forms of reflectors may be employed, so as to render the whole of a more effective or ornamental character, or for the purpose of concentration upon a particular object.

The tenth part has reference to the construction of gas-burners, the first of which he calls the "Ronald," which consists of two or more jet pipes, all inclined to one common centre, by which the jets of gas issuing from the apertures are caused to impinge or commingle with each other, by which a more perfect combustion is effected than by the ordinary jets. A gas-light of this description is placed in a glass basin or shade, having a close bottom, by which any admission of air in that direction is prevented, which has, consequently, to pass over the lip or edge of the glass. In the burner shown, four jet pipes are inclined, as described, but other numbers may be employed. In this kind of burner the chimney is dispensed with, as in the fish-tail burner.

The next improvement in gas-burners consists in what he calls the "concentric gas-burner," which consists of a plate, in which are a series of concentric circles of holes, which circles communicate alternately with the gas-pipe and the atmosphere, so that, on the combustion of gas taking place, a series of alternate films of gas and air are emitted from the several circles of apertures, producing a more perfect combustion of

the gas, and, consequently, a more brilliant light than is produced by other gas-burners.

A modification of this burner is also shown, for the production of a flame of greater length than that produced by the last, the jets being, in that case, all on the same plane. In this burner the concentric circles are placed at different altitudes, the centre circle being at the top, and arranged in steps, embracing two circles at each step, that is, an air circle and a gas circle, on the same level, in which order they rise to the top; the entire altitude depending on the length of the flame required.

The next improvement in gas-burners consists in the construction of gas-burners, which he calls the "Russell," in which the apertures for the emission of gas are so arranged that they are capable of being enlarged or diminishsd, for the purpose of increasing or contracting the flame. This is effected by forming the burner of two conical parts in one case; the outer ring of the burner (which is circular) is conical on the interior, having a conical centre piece, which is fitted to the burner, so that its altitude can be readily varied by means of a screw, or it may be the outer ring to screw down upon the conical centre piece, by which the space between the two cones may be increased or diminished, this forming the aperture for the emission of the gas; being in communication with the gas-pipe. Another form is represented in which the cones are inverted, the arrangement of adjusting by means of a screw being identical with the previous burner. Air is admitted to the centre and on the outside of the flame as in the ordinary argand burner.

The eleventh part has reference to the construction of candle-lamps and candles, which he designates the "Argand;" this consists in forming candles with a hollow wick made of some fibrous vegetable material, which is entwined with metallic threads, such as zinc or other soft metal. These wicks are used for candles in such manner as to maintain the hollow of the wick, and by which air is admitted to the centre of the flame. In burning these candles in candle-lamps he forms the candle-rest with a hole in the centre to correspond with the hollow wick, air being admitted through holes in the base of the lamp for the supply passing up the wick.

The twelfth part of this invention has reference to an improved whirling-machine, such as employed for separating moisture from various substances, for the purposes of drying, or otherwise. The principal feature of the improvement is that the rotary case or cylinder (instead of having a continuous rotary motion imparted thereto) has a reciprocating rotary motion—that is, rotating first in one direction, and then in the opposite direction; by which the accumulation of the substances at points in the circumference is avoided. By such accumulation the moisture is prevented separating from the substance under operation. The reciprocating rotary motion may either be communicated by hand, with two cords wound on the spindle in opposite directions, as in twirling a mop; or any well-known mechanical means may be resorted to for the purpose. The spindle is constructed hollow, and is in communication with vessels containing gas, air, or steam, which, drawn through by the centrifugal force induced by the rotation of the machine, escapes at perforations in the spindle; the gas or steam mingling with the substances to be dried, or otherwise acted on, and for which the vapour so introduced may produce an accelerated or otherwise beneficial result.

The thirteenth part refers to the introduction of air in a warm or cold state, where such is used for the purposes of manufacture, as in the evaporation of sugar. Where the air is introduced in a heated state, he employs a coil of pipes in the form of a pyramid, placed in a furnace, by which the action of the fire is more direct; this is allowed to circulate through a receiver, from which pipes are carried, so as to conduct the air into a chamber below the pan, or material to be acted upon by the heated air, and also up through other pipes which convey it into the vertical spindle of a rotating wheel, immersed in the liquid under operation, and escaping through apertures in the arms, by which it is projected at an inclination downwards. This wheel is driven in the direction in which the escape of the air tends to impel it, by means of gearing, and also has a vertical motion in the fluid, by which the air is thoroughly diffused therein. This air-wheel is employed when the application of heated air to the bottom of the containing vessel is insufficient. The whole is covered over, and the air passing under to heat the bottom is carried over, so as to impinge on the surface of the fluid; the temperature being regulated by valves on the various pipes, and also by the admission of cold air if required.

Cold air alone may also be diffused in liquids, by means of the air-wheel as described.

An air-wheel was previously patented by the present patentee, in which this constitutes an improvement, in so far as regards the direction of the apertures, and the vertical motion imparted thereto.

He also applies this air-wheel to the introduction of gas to the purifier; the wheel being immersed in the solution of lime revolves and distributes the gas in the liquid, by which it is purified, and is collected in a dome top and conveyed to the holder. The wheel in this case has no vertical motion.

The patentee claims:—

First. The apparatus for heating water and other fluids, in so far as regards the construction of the two cylinders, in the manner described.

Secondly. The construction of boiler and other furnaces, with two, three, or more rows of pillars of brickwork placed immediately behind the fire-bars, and with air passages leading from the top of the brickwork to beneath the fire-bars, and to which construcion he has given the name of "Ronald."

Thirdly. The method of generating steam of low pressure by the application of high-pressure steam, and also the self-acting condensing-box used in connection therewith.

Fourthly. The method of heating sugar-pans by means of a moveable furnace mounted on wheels and axles, and running on a railway if desired.

Fifthly. The gas-heating stove which he has called the "Ronald," in the peculiar combination of parts of which the same consists.

Sixthly. The first of the two gas-exhausting apparatus described, in so far as regards the employment of the two valved pipes or compartments, one of which acts as the inlet and the other for the outlet of the gas; these pipes being within a vessel immersed in water, and the vessel covered over at the top by an inverted vessel, in so far as regards the mode of occasionally closing the said pipes or compartments at the lower ends by columns of water, and also the application of certain parts of the said apparatus, and other apparatus partaking of the same nature, to the measuring and registering of the gas which is passed through it as described.

Seventhly. The governor used in connection with the apparatus mentioned in the last claim, and also the application thereof to gas-exhausters generally.

Eighthly. The three rotary or wheel gas-exhausters described each in the peculiar arrangement and construction of the parts of which it consists.

Ninthly. The divergent coal fire-stove, and also the revolving coal fire stove, with revolving reflectors or shield, both as before described, and to which he has given the name of "Garrow."

Tenthly. The moveable or divergent gas-stove, in so far as regards the construction, by means of which the light and heat generated by the combustion of gas may be directed to, and concentrated upon, any particular object or part of an apartment.

Eleventhly. The gas-burner named the "Ronald," in so far as regards the employment therein of two, three, or more jet-pipes, shaped and placed so that the streams of gas issuing therefrom shall be ejected obliquely towards the centre of the burner, and impinge against, or commingle with, each other; and also closing the bottom of the glass shade against any admission of air to the burner from beneath (the ordinary chimney being dispensed with). He further claims the application of close-bottomed shades to all other burners for which they may be suited.

Twelfthly. The concentric gas-burner, and conical concentric gas-burner, each in the peculiar arrangement and construction of parts of which it consists.

Thirteenthly. The candle designated the "Argand," and also the candle-lamp described, in so far as regards the combination of a hollow wick, with apertures at the base for the admission of air to the interior of such wick, and also the employment generally in candles of hollow wicks made of vegetable fibrous material, entwined or otherwise combined with threads of zinc, or soft metallic compounds.

Fourteenthly. The three gas-burners denominated the "Russell," in so far as regards the means, provided in each, for opening and enlarging the aperture through which the gas is emitted.

Fifteenthly. The improved whirling apparatus for drying substances, in so far as regards the means of giving a reciprocating rotary motion to the hollow cylinder; that is to say, a rotary motion, first in one direction, and then in the opposite direction.

Sixteenthly. The several methods of applying air in a warm or cold state for manufacturing purposes, described under the last part of this specification, each in the peculiar arrangement, combination, and adaptation of the parts of which it consists, and also the improvements enumerated in the air-wheel formerly patented by him.

Seventeenthly and lastly. The application of his improved air-wheel to the purification of coal-gas, as hereinbefore described.

In the second part of this specification the patentee has described a construction of furnace for steam and other boilers which he denominates the "Ronald," but which we should be more inclined to call the "Collins," seeing that it is identical with the invention specified and enrolled by Mr. Collins, of Leominster.

William Henry Green, of Basinghall-street, in the city of London, gentleman, for improvements in the preparation of fuel. Patent dated March 5th, 1849. Enrolled September 5th, 1849.

These improvements in the preparation of fuel have reference:—

First. To a modification of drying peat to be used as fuel; and

Secondly. To the charring of peat in a manner that will admit of the volatile oils, and other volatilizable substances it contains, being driven off without the great waste of carbon taking place that is experienced from the ordinary mode of charring peat.

With reference to the drying of peat, the patentee cuts it into rectangular blocks suitable for burning, which, by preference, are first partially dried in the open air, after which they are subjected to the action of a drying-chamber. This drying-chamber is furnished with a perforated metal floor, having the apertures in regular order, so that the faggots or blocks of peat may be piled up between them, thereby admitting free ingress for the heated air to be introduced. Furnaces are built under the level of the flooring, the flues from which traverse several times across in their way to the chimney. Short vertical tubes are placed at regular intervals throughout the length of these flues, the tubes passing through the bottom of the flues, where they have a free admission of air, which, becoming rarefied, passes out at the top of the pipe, and is admitted into a chamber below the floor, throughout which it is equally distributed. The roof of the building is provided with an ordinary ventilator, for the escape of the heated air, which enters through the perforated floor,

and, ascending, envelops the peat in a heated atmosphere, which should be raised to about 150° F., which is to be maintained for twelve hours, when the peat will be thoroughly dried, and in a state of preparation suitable for burning. It is not indispensable that the peat should be piled in the chamber so as to leave the perforations free, as the peat may be thrown into the chamber; but it will be necessary to employ an exhausting apparatus in connection with the roof, in order to draw the air through, the rarefaction not producing sufficient pressure for the purpose; valves are placed in the air-channels, by which the admission of air may be regulated.

The second part, relating to the charring of peat, is conducted in retorts set in brickwork, in ranges, the ends passing out at either side, and both fitted with doors, through which the charge is introduced and withdrawn. The retorts, in transverse section, have the bottom and sides rectangular, with an arched top, the bottom or sole resting on the brickwork, while the whole of the sides and top are exposed to the action of the heated flues. A furnace is built between each pair of retorts, or so as to work two retorts, being constructed on a lower level, and having two flues leading to the space surrounding the retorts, dampers being placed on each channel, so as to regulate the passage of the products of combustion, in order to equalize the heat of the retorts; the heat circulating through the space surrounding the retort passes thence into the chimney; peat fires being lighted in the furnace for about twelve hours, the retorts, which are of thin sheet iron, are charged with the peat, which is first placed in baskets adapted to the retorts, which, if about six feet long and two feet wide, may contain four baskets as a charge, which being introduced, the doors are secured and luted round, the outer door being protected from the heat by an air space between it and an inner door of fire-tile. The fire in the furnace is continued, keeping up a cherry red heat in the retorts during the charring process; each retort has two pipes, by which the volatilizable substances escape, and are all conducted into a main pipe leading to a condenser, where the tar or other product is deposited, the gas escaping by another inclined pipe to a gasholder, to be used as a fuel in the charring process, the inclination of the gas-pipe causing any matters carried off with the gas from the condenser to return thereto; jet-pipes are placed on the several escape-pipes from the retorts, by which the attendant is enabled to ascertain the progress of the operation by lighting the jets from time to time, which when burning very feebly are indicative that the operation is complete, when a fresh charge is introduced, the charge being withdrawn at the opposite door, while the new charge, previously prepared in baskets, is introduced at the other.

The patentee claims:—

First. The mode of supplying heated air to the drying house or kiln for the drying of peat and preparing it for fuel in the manner described.

Secondly. The arrangement of apparatus for charring, as described, whereby he is enabled to ascertain the progress of the operation, and to stop it at any required stage of the charring process, by which a great economy is effected in the production of peat charcoal.

Michael Loom, of Treskerley, in the county of Cornwall, engineer, for improvements in the manufacture of fuzees. Patent dated January 11th, 1849. Enrolled July 11th, 1849.

This specification describes an improved mode of manufacturing fuzees for mining and blasting purposes. At the bottom of a hopper-shaped vessel, which contains the gunpowder or other combustible of which the fuzees are to be made, is placed a curved mould or die, and through which is passed the tape or other suitable narrow fabric which is to enclose the combustible material, the tape being wound off a reel or bobbin, and passed through the apparatus in a continuous length. The tape, in passing through the bottom of the hopper, assumes a semi-cylindrical shape, into which a quantity of the combustible material passes. The tape, still in this semi-cylindrical shape, containing upon it a quantity of the combustible material, passes on and through a circular opening in the centre of a pin or axis. It here assumes a cylindrical shape, the tape now wholly enclosing the combustible material. Upon the stud or axis is a plate or disc, to which a rotary motion is given; there are several bobbins, carrying threads, placed upon the revolving plate, and these threads are thereby wound round the cylindrical fuzee as it issues from the pin or axis, thus binding and preserving the cylindrical form, and retaining the combustible material within it. It is now wound upon a reel, and is finished by covering it with some waterproofing material, to preserve the combustible material from moisture, and is then in a fit state for use.

The patentee states that the cylinder of tape may be wrapped round with tape, instead of threads; and he claims the mode described of manufacturing fuzees.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING SEPTEMBER 6, 1849.

Alexander Haig, of Smith-street, Stepney, engineer, for an improved apparatus for exhausting and driving atmospheric air and other gases; and for giving motion to other machinery. Patent dated September 6th, 1849; six months.

Alexander Robert Terry, of Manchester-street, Manchester-square, engineer, for improvements in the manufacture or preparation of firewood. Patent dated September 6th, 1849; six months.

Josiah Marshall Heath, of Hanwell, in the county of Middlesex, gentleman, for improvements in the manufacture of steel. Patent dated September 6th, 1849; six months.

Sir John M'Neill, knight, of Dublin, and Thomas Barry, of Lyons, near Dublin, mechanic, for improvements in locomotive engines, and in the construction of railways. Patent dated September 6th, 1849; six months.

John Hosking, of Newcastle-upon-Tyne, engineer, for an improved pavement. Patent dated September 6th, 1849; six months.

Captain Fitzmaurice's Rotary Engine.—Several private trials were recently made at Taplow-on-the-Thames with a rotary engine, which has been brought to its present working condition by Captain the Hon. W. E. Fitzmaurice (late 2d Life Guards) and his brother-in-law, Mr. Harford. The engine is very simple, merely consisting of two pieces, so mathematically arranged that the interior part works in the outer with the greatest ease, being free from dead points, and without the slightest vibration, however great the velocity. It has no springs or packing, and the parts meet each other so harmoniously as only to give a humming noise like that of a spinning-top. It is not in the least liable to get out of order, the wear being perfectly uniform throughout. The entire motion being a rolling instead of a cutting one, the engine will last long without repair, as the surfaces become case-hardened in a very short space of time. The trials took place in the presence of several scientific gentlemen and engineers of eminence in their profession, in a frigate's pinnace, the engine being constructed for the Government. The boat is of ten tons burden, carrying a load of five and a half tons, and drawing four feet of water. She is thirty-two feet long, and has eight feet breadth of beam; she is made for carrying men and carronades, but is not in any way calculated for speed, and yet the engine of ten-horse power, occupying a space of twenty-one inches by seven inches, drove a screw propeller of three feet in diameter, and four feet pitch, with such velocity as to make 200 revolutions in a minute, the motion being given on the direct-action principle. Although the boat was not at all calculated for speed, she was propelled against the stream a distance of two miles in twenty minutes, equal, allowing for the strength of the current, to eight miles an hour. The engine weighs considerably less than one cwt. to each horse-power, and requires much less fuel than the ordinary engines, and is so easily set in motion, graduated to any velocity, or stopped, that a boy of twelve years of age might manage it with one hand. It was made under the superintendence of Mr. Bulman, jun., of Croydon, who has given great satisfaction to his employers; and the best judges have pronounced a high opinion of its capabilities after witnessing its performances. Captain Fitzmaurice makes no secret of the invention; but shows its interior freely, as it is intended for the public service. An engine of 100-horse power, on Captain Fitzmaurice's construction, would not occupy a space of six feet by eight feet.

TO CORRESPONDENTS.

"A Student of Analytical Chemistry."—Chemically pure concentrated sulphuric acid for chemical experiments and researches is prepared best by the following process:—Pour from three to four pounds of common sulphuric acid into a capacious glass retort, which should be coated over outside with a paste made of clay and cowhair. Throw a coil of platinum wire, or a few fragments of platinum, into the retort, and place the latter in a wind-furnace (to be covered subsequently with a cap or helmet). Introduce now the neck of the retort into the body of a large spherical receiver without luting. Heat the contents of the retort gradually to boiling by surrounding the retort with red-hot charcoal, taking care to make the fire act principally upon the top and sides, and less upon the bottom, of the vessel. The acid which passes over first contains an admixture of nitric acid. It is necessary, therefore, to change the receiver after the lapse of some time, in order to obtain absolutely pure acid. The distillation should be continued until about three quarters of the acid in the retort have passed over.

"A Subscriber" is referred to No. 138 of the *Chemical Times*.

"B. R."—We do not know.

"G. C." will receive a private communication.

"G. T. S."—No duty is leviable, but a licence is required.

"R. W."—To make unfermented bread, proceed as follows:—Divide eight pounds of flour in two proportions; mix up the first with water holding in solution two ounces of bicarbonate of soda, and the second with another portion of water acidulated with one ounce of hydrochloric acid. When each mass of dough has been separately well kneaded to a proper consistence, mix them together as quickly as possible; form the mass into loaves, and bake them at once.

"Mr. Weber, Kennington."—To prepare coloured fires, proceed as follows:—Blue: 5 parts nitre, 2 parts sulphur, 1 part metallic antimony. Mix.—Crimson: 4¼ parts chlorate of potash, 67¼ parts nitrate of strontia, 5¾ parts charcoal, 22½ parts sulphur. Mix.—Green: 62½ parts nitrate of baryta, 10½ parts sulphur, 23¾ parts chlorate of potash, 1¾ parts charcoal, 1¾ parts sulphuret of arsenic. Mix.—Lilac: 49 parts chlorate of potash, 25 parts sulphur, 20 parts dry chalk, 6 parts black oxide of copper. Mix.—Purple: 42 parts chlorate of potash, 42 parts nitre, 22¾ parts sulphur, 10 parts black oxide of copper, 2¾ parts sulphuret of mercury. Mix.—Red: 72 parts dried nitrate of strontia, 20 parts sulphur, 6 parts gunpowder, 2 parts coal-dust. Mix.—White: 46½ parts nitre, 23 parts sulphur, 12¼ parts gunpowder, 18 parts zinc powder. Mix.—Yellow: 74½ parts dried nitrate of soda, 19½ parts sulphur, 6 parts charcoal. Mix.—Some of these compositions are liable to undergo spontaneous combustion when kept for some time, even when enclosed in bottles. Serious accidents have arisen from this cause.

"A Chemist."—1 part of sulphuric acid to 5 parts of water.

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ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXXV.

(LECTURE OVIII.)

VEGETO-ALKALIS—(*Continued*).

DELPHIA.

This vegeto-alkali has as yet been found only in the seeds of the stavesacre (Delphinium staphysagria), a plant belonging to the tribe of the Ranunculaceae.

The formula of delphia is, according to Couerbe's analysis :—

$C_{27}\ H_{19}\ O_2\ N.$

Delphia is a white pulverulent body; whilst moist its texture appears crystalline. It has no smell. It has an intensely bitter and exceedingly acrid taste. It causes violent irritation in the mucous membrane of the nose, without, however, provoking sneezing.

Delphia fuses at 248° Fahrenheit.

Delphia is very sparingly soluble in water, but it dissolves very readily in alcohol and in ether.

The alcoholic solution of delphia changes the colour of the syrup of violets to green.

Delphia saturates acids. Its salts are bitter and acrid. They crystallize with difficulty. Upon the addition of alkalis to solutions of salts of delphia, this base separates in form of a white jelly.

Delphia is procured most readily by the following process, for which we are indebted to M. Couerbe :—

Treat the seeds of the stavesacre* repeatedly with boiling alcohol of 88 Cent., and evaporate the alcoholic liquors to the consistence of an extract. Boil this extract in water acidulated with sulphuric acid, and repeat this operation several times, and until the water ceases to acquire a perceptible coloration from the extractive mass, or until addition of a mineral alkali fails to produce a precipitate. Collect the liquors obtained in these several processes of decoction, and precipitate the delphia by means of potass or ammonia. Redissolve the precipitate in boiling alcohol, digest the solution with animal charcoal, and evaporate. Dissolve the powder once more in boiling water acidulated with sulphuric acid, and precipitate the delphia again with an alkali.

The powder procured in this manner is sufficiently pure for medicinal purposes ; but it is not chemically pure. It contains, according to Couerbe's observations :—

1. A resinous matter, which may be removed by dissolving the powder in sulphuric acid and precipitating the solution with nitric acid;
2. Pure delphia.
3. Staphisin.

Staphisin is a species of resinous matter insoluble in ether, and may, accordingly, by means of that agent, be readily removed from the delphia.

Delphia is rarely employed in medicine ; it is held to act upon the nervous system as an excitant. Some practitioners have suggested its application against chronic glandular tumors. Dr. Turnbull has employed it sometimes, both internally and externally, instead of veratria in nervous affections. Frictions with delphia ointment or pomatum produce a pricking sensation in the skin, and a feeling of shuddering. Given internally, delphia does not cause nausea, as veratria does, and it is, therefore, employed in preference to this latter in toothache, earache, &c. The formulæ, modes of administration, and doses, are the same as for veratria.

* The stavesacre of Germany is the richest in delphia, and is, therefore, generally preferred to the other varieties, as far as the extraction of that vegeto-alkali is concerned.

STAVESACRE.

The seeds of the stavesacre (Delphinium staphysagria) contain :—

Stearine,
A fatty oil, sparingly soluble in alcohol,
A fatty oil, very readily soluble in alcohol,
Gum,
Starch,
Nitrogenous matter,
Soluble vegetable albumen,
Coagulated vegetable albumen,
Delphia,
Volatile acid,
Sulphates and phosphates of potass, lime, and magnesia.

The medicinal properties of the seeds of staphysagria seem to be attributable entirely to the delphia and the volatile acid.

Delphia was discovered by MM. Lassaigne and Feneulle. It exists in the seeds of the stavesacre, in combination with an acid matter which has not yet been examined.

The volatile acid was discovered by Hofschaiger. It is a white, crystalline, volatile, acrid substance, analogous, no doubt, to the common acrid principle of the Ranunculaceæ.

POWDER OF STAVESACRE.

Reduce the seeds to powder, without leaving a residue.

LOTION OF STAVESACRE.

Take of Powder of stavesacre, 16 to 32 grammes.
Water, 1,000 grammes.

Boil ; strain the decoction.

This lotion has been used successfully against the itch and other cutaneous affections.

TINCTURE OF STAVESACRE.

Take of Stavesacre, 1 part.
Alcohol of 80 Cent., 2 parts.

This tincture has been employed by Dr. Turnbull in frictions for the same purposes as the preparations of delphia.

POMATUM OF STAVESACRE.

Take of Powder of stavesacre, 1 part.
Hogslard, 3 parts.

Digest in the water-bath; strain with expression ; let the pomatum cool, and, when cold, remove the fœces.

Or

Take of Powder of stavesacre, 1 part.
Simple cerate, or hogslard, 24 parts.

Mix.

These formulæ are both by Swediaur.

The pomatum of stavesacre is employed to destroy lice.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON THE PREPARATION OF THE HYPOSULPHITE OF SODA.

By M. FAGET.

The composition of this salt as met with in commerce is not always the same; it varies according to the process employed in its production. When it is prepared with the bisulphite of soda and sulphur the product consists of a large quantity of sulphate and but little hyposulphite.

It is best procured by boiling the neutral sulphite with sulphur. However pure the neutral sulphite may be the hyposulphite will be mixed with a small quantity of sulphate. M. Pelouze explains the presence of this sulphate by the decomposition of the boiling water in the presence of sulphur and the hyposulphite. I have never, however, been able to detect the least trace of sulphuretted hydrogen even on boiling the hyposulphite with sulphur for a long time. I should rather explain the presence of this gas by the simultaneous action of the water and sulphur upon the excess of alkaline carbonate which is added to the bisulphite to transform it into the neutral sulphite.

The best process for procuring the neutral sulphite consists in dividing a solution of alkaline carbonate into two parts, saturating one with sulphurous acid gas, and afterwards neutralizing it with the second portion of the carbonate. When a solution of carbonate of soda is saturated with sulphurous acid gas the liquid not only contains all the gas forming the bisulphite, but also that which the water of the liquid retains in solution. Hence, when the first portion is neutralized by the second, we do not obtain a neutral solution, but a mixture containing excess of the bisulphite. It is, therefore, best to introduce the neutralized liquid into a large flask, to boil it alone at first, and not to add the sulphur which is to convert it into hyposulphite until the excess of sulphurous acid has escaped. In following this plan almost the whole of the soda is converted into the hyposulphite. If requisite, the salt may be purified by recrystallization.

M. Plessy adopts a method of purifying the hyposulphite which is also used with great advantage in the preparation of pure carbonate of soda from the impure commercial crystallized carbonate. The salt is melted in its water of crystallization, and the heat is continued so as to evaporate a portion of the water. When the solution cools the hyposulphite alone crystallizes, the mother liquor retaining the impurities. If the hyposulphite does not contain any sulphate, it will not, when dissolved in a large quantity of water, precipitate salts of baryta.

I may mention an easy process for determining the identity of the salt. It is based upon the alteration which it undergoes when heated, and consists in ascertaining the weight of the residue obtained by calcination, and examining if it contains sulphur. From fifteen to thirty grains are introduced into a tube closed at one end. The tube is then carefully heated to drive off the water of crystallization; and, when the salt is completely dried, the heat is increased, and the tube heated throughout its whole length, so as to expel the volatilized sulphur which has been condensed upon its internal surface. On calcination the hyposulphite yields sulphur, sulphurous acid, and a residue of sulphuret and sulphate. When the tube has cooled it is again weighed. If the salt be pure the residue should amount to about 44.6 per cent. of the salt. The presence of sulphuret in the residue is easily determined by treating it with water and adding a drop of solution of subacetate of lead; that of sulphuric acid by a salt of baryta. Of all the oxysalts formed by sulphur the hyposulphite is the only one which yields sulphur on calcination. The neutral sulphite of soda (SO_2, $NaO + 10HO$), which is inodorous, also yields sulphuret; but on calcination it neither gives sulphur nor sulphurous acid, and the residue which it leaves amounts to 40.5 per cent.—*Journ. de Pharm.*

ON THE METAMORPHOSIS OF MALIC ACID INTO SUCCINIC ACID.

By M. DESSAIGNES.*

Asparagine, as shown by M. Piria, may be regarded as the amide of malic acid. When it is impure and dissolved in water it soon ferments, and is converted into succinate of ammonia. I conceived that, if malic acid or one of its salts was susceptible of experiencing the same kind of fermentation, the relations discovered by M. Piria between asparagine and malic acid would receive a more complete demonstration.

The neutral malate of lime, as obtained by Liebig's process from the berries of the mountain ash, was left under a somewhat deep stratum of water, and in a vessel covered merely with paper, in the autumn of 1847. After three months the

* This is the paper alluded to in page 152 of the present volume (On the Preparation of Succinic Acid from Malate of Lime. By Professor Liebig.)

water was partly filled with a mucilaginous organized product, in which and upon the sides of the vessel a multitude of beautiful crystals of hydrated carbonate of lime were perceptible. The filtered water furnished a slight precipitate with acetate of lead. The formation of the carbonate of lime and of the mucilage ceased; and as the temperature rose, that is to say, during the spring and summer of 1848, I observed above the malate of lime, which perceptibly decreased, a layer of very delicate aggregated crystals; this layer was heaved up by some large bubbles of gas which had proceeded from the malate of lime. On dissolving these crystals in hot water, precipitating with carbonate of soda and filtration, I obtained a slightly-coloured solution, which precipitated acetate of lead, nitrate of silver, neutral perchloride of iron, and the chloride of barium when mixed with alcohol and ammonia. The concentrated liquid, treated with a slight excess of hydrochloric acid, evaporated to dryness, and the residue frequently exhausted with boiling ether, furnished a solution which left on spontaneous evaporation beautiful colourless prisms of a volatile acid, which burned with flame, leaving no residue upon the blade of platinum; it was, in fact, succinic acid.

The silver salt, well washed and dried at 212°, furnished on calcination 64.80 per cent. of silver; theory requires 65.6. The acid, purified by solution in water and dried at 212°, gave on combustion with oxide of copper:—

	Found.		Calculated.
Carbon.....	40.88	..	40.68
Hydrogen.....	5.25	5.23	5.08
Oxygen.....	..	..	54.24

The succinic acid represents a considerable part of the weight of the malate of lime submitted to fermentation. I hope soon to determine approximatively the quantity.

Asparagine appears to exist in the young shoots of all the plants belonging to the numerous family of the Leguminosæ. All the seeds belonging to plants of this family which I have grown have furnished it in large quantity; I may mention broad beans, French beans, lentils, peas, clover, lucerne, sainfoin, and Cytisus laburnum. What common principle do these seeds contain which is metamorphosed in the act of germination into asparagine? Is it legumine? This question I shall endeavour to solve next spring.—*Comptes Rendus.*

OBSERVATIONS ON THE EMPLOYMENT OF THE SESQUIBASIC PHOSPHATE OF SILVER IN MINERAL AND ORGANIC ANALYSIS FOR DECOMPOSING THE ALKALINE AND EARTHY CHLORIDES.

By J. L. LASSAIGNE.

Chenevix was the first to advise the use of the sesquibasic phosphate of silver for separating the chloride of barium from the chloride of baryta in the preparation of the latter salt. It is by means of this process, now nearly abandoned, that this salt was first obtained in the state of purity, and that chemists were enabled to study its principal properties.

The decomposing action which the hydrated sesquibasic phosphate of silver exerts on the alkaline and earthy chlorides induced me to use this metallic salt, first, to isolate certain nitrates from alkaline and earthy chlorides; and secondly, for the separation of the saccharine principles mixed with chloride of sodium, as they occur in certain organic products.

I applied the first method to the analysis of a well water. It is well known that the salts soluble in strong alcohol consist principally of chlorides of magnesium and calcium, frequently associated with nitrates in greater or less quantity. Wishing to ascertain the relation between the nitrate of magnesia and chloride of magnesium contained in a mixture obtained by alcohol from the residue of a well water from the neighbourhood of Paris, I tried the hydrated phosphate of silver upon the solution of these two salts; and was soon convinced that, with the assistance of a gentle heat, the chloride of magnesium is entirely converted into insoluble chloride of silver and subphosphate of magnesia, whilst the nitrate remained in solution and could be procured by evaporation. This simple method may, therefore, be applied in a number of circumstances; it also answers for a mixture of nitrate of lime and chloride of calcium. However, a minute quantity of phosphate of silver is held in solution by the alkaline nitrate; but this quantity is exceedingly small, and may easily be taken into account in a quantitative analysis. The separation of an earthy nitrate from a chloride is best effected by evaporating to dryness the solution in which an excess of the hydrated phosphate of silver has been suspended, and then treating the residue with cold distilled water, in order to isolate the insoluble products formed by filtration.

It is by operating in this way that I have been able to determine in a direct manner the minute quantity of nitrate of magnesia which was mixed with chloride of magnesium in the residue of the well water. This process may be advantageously used in the analyses of mineral waters for effecting analogous separations.

The phosphate of silver may also be employed for the isolation of cane and grape sugar when mixed with a small quantity of chloride of sodium. These two substances, soluble in alcohol, sometimes occur together in certain organ products. By the action of the phosphate of silver on a solution of such a mixture, there is formed at the ordinary temperature insoluble chloride of silver and soluble phosphate of soda, which remain mixed with the sugar. Now, the phosphate of soda being insoluble in alcohol of 0.869 spec. grav., whilst the sugar, on the contrary, is soluble in it, it is possible to effect their separation by acting with alcohol on the product evaporated to dryness. Direct experiments showed that cane and grape sugar isolated by this method contained not a trace of the chloride of sodium which had been intentionally mixed with them. By acting in the cold and quickly on the soluble principles, in order to isolate them from the chlorides which they may contain, no fear need be entertained of the reducing action of the organic substances on a portion of the phosphate of silver.—*Comptes Rendus*, August 13, 1849.

OBSERVATIONS ON THE ESTIMATION OF NITROGEN ACCORDING TO DUMAS' METHOD.

By Prof. MULDER.

The author observed, in determining nitrogen according to this method, that, when substances containing a very large amount of carbon and hydrogen were analyzed, a gas which burnt with a blue flame (carbonic oxide) was formed. This took place notwithstanding the greatest precaution in conducting the analysis. The cause of this production of carbonic oxide was owing to the circumstance, that the carbonic acid which is disengaged from the bicarbonate of soda after the combustion is reduced to carbonic oxide on passing over the incandescent unconsumed carbon. This carbonic oxide is not reconverted by the oxide of copper into carbonic acid, because the disengagement of the carbonic acid intended to expel the nitrogen is generally not sufficiently slow, and the carbonic oxide is carried away by the rapid current of carbonic acid.

But, even when the carbonic acid was very slowly disengaged at the commencement, this evolution of carbonic oxide still occurred. It is, therefore, necessary to attend to this the more, as experience has sufficiently shown that some bodies cannot be perfectly burnt without oxygen. These, therefore, inasmuch as they leave a residue of carbon when treated according to Dumas' method for estimating the nitrogen, must furnish carbonic oxide, which mixes with the nitrogen, and renders the determination of its amount erroneous. In such cases a more intimate mixture of the substance to be analyzed with the oxide of copper is advisable, and also to let the carbonic acid disengaged towards the end of the combustion from the bicarbonate of soda pass at first very slowly over the oxide of copper, in order that the carbonic oxide may be converted into carbonic acid.—*Scheik. Onderzoek*, 1849, p. 377.

ON THE PREPARATION OF IODIDE OF POTASSIUM.

By M. CRIQUELION.

Take—

Iodine	94 parts.
Iron filings	14 "
Calcined lime	40 "

First slake the lime in water, then carefully incorporate the iron filings, upon which add the iodine in small portions to the mixture, and triturate until a drop of the liquid produces only an ochreous stain upon starched paper. It is then filtered, the residue mixed with water, and the clear solution precipitated with carbonate of potash. The carbonate of lime is separated by filtration, and the solution evaporated to crystallization.—*Journ. de Chem. Méd.*, iv., p. 429.

NINETEENTH MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

[*Continued from page* 198.]

Section A.—Mathematical and Physical Science.

"On an Atmospheric Phenomenon seen in Switzerland," by Sir R. H. Inglis.—This communication was made at the time the phenomenon was witnessed, by letter to Col. Sabine:—"Aug. 8, 1849.—We were at Gais (Canton Appenzell, Switzerland) a few days ago, and saw there what may be familiar to you and other men of science, but was quite new to me and to the people of the place. About 3 p.m., on the 8th of August, my servant called to me 'that there was something falling, very curious.' I went out to the bridge which connects the old and new buildings of the Hotel du Bœuf, and, under the shade of the new house, looked up and saw thousands and thousands of brilliant white motes, like snow, falling as in flakes. There were no clouds, but there was a kind of halo round the sun, or rather, as I looked up, there were in that direction apparently more and larger masses through which the rays passed; balls separated themselves, consisting of vast numbers; and these resolved themselves into fragments, and came whirling and floating about. The master of the hotel, M. Heen, joined us; he had obviously never seen anything of the kind before, and called out 'Des millions, des millions.' He summoned his people to look. I continued to gaze till I was half blinded. At first the fragments seemed to melt; and to the last I could distinguish no appearance of an animal. Our servant fancied that he saw something like wings. I certainly looked till, to my eye, they seemed to evaporate, but their disappearance, and perhaps the reappearance of the same individual, might have been owing to their turning at right angles instead of exhibiting their extent lengthways, and *vice versâ*. This lasted—at least, I looked—twenty-five minutes. Certainly none came to the ground. Réaumur 20°; no wind. Gais is 3,100 ft. above the sea."

Sir R. Inglis then read extracts from a letter from Sir J. Herschel containing some notices of similar phenomena:—"Of analogous facts (more or less so) I can mention two: 1. In or about the year 1821, I remember seeing in Sir J. South's telescope, at Blackman-street, when turned in a direction near but not to the sun, about midday, frequent objects, having all the appearance of stars, which were seen sailing through the field of the telescope. Dr. Wollaston, when this was mentioned to him, said it was thistledown; I do not think it was. 2. In the hay season, some three or four years ago, the

day being clear and hot and calm (at least in the immediate neighbourhood of our house), our attention was excited by what at first seemed to be strange-looking birds flying, but, though presently assured they were not birds, it was by no means clear what they were. They were irregular wispy masses, sailing leisurely up and settling down again, apparently over a hay-field on the east of our grounds, and about a quarter or three eighths of a mile from our house. Some of these were of considerable size, and their general appearance was convex downwards and taily upwards. After wondering awhile, I got a telescope and directed it to the flying phenomenon, when it became evident that they were masses of hay, some of very considerable size, certainly not less (allowing for the distance) than a yard or two in diameter. They sailed about leisurely, and were very numerous. No doubt wind prevailed at the spot, but there was no roaring noise nor any sign of a whirlwind, and all about us was quite calm. Nobody was at the time at work in that field. None fell on our side of the trees, above which they rose perhaps 50 or 100 feet.—P.S. Could Sir R. Inglis's phenomenon have been winged ants? They sometimes appear in astonishing numbers, and might associate like gnats in masses for a dance and separate again."—Sir R. Inglis added that he had set down this communication as an "atmospheric phenomenon" rather for the purpose of giving it a title than as intending to express a fact, his own private conviction being that they were some kind of insect.

Col. Sabine stated that Humboldt had recorded several instances when in the Caraccas of hay, straw, sand, and even larger objects, being carried up bodily into the air, whirled about, and scattered in it, rising on the one side of the mountain, carried over it, and again descending on the opposite side, with the descending atmospheric column which had raised them. Instances also were recorded of large masses of ice, which, from the great elevation at which they were, seemed to float about, and produce interesting appearances.—Dr. Robinson mentioned one instance in which the fall of a mass of ice of about 15 feet across was recorded as having occurred. He also stated that he had sometimes found that the wings of rooks, as they turned round in the sunbeams under favourable circumstances, reflected so strong a beam of light as to penetrate the shade used to protect the eye when looking at the sun. This appearance, when it first occurred to himself, gave him much trouble to account for, and he now mentioned it to apprize those of the fact who might mistake this appearance for meteors crossing the sun, or even for something taking place on its surface.—Sir D. Brewster mentioned several instances of large objects carried up into the air in Scotland, as also of masses of ice which had fallen of unusual magnitude.—Prof. Stevelly said that, besides the recent instances recorded by modern travellers of pillars of sand raised into the air in the deserts, Ulloa, in his account of the voyage of the associate French and Spanish philosophers to measure a degree near the equator, had recorded as of regular daily occurrence the moving of numerous and vast pillars of sand and other debris across the extensive plains which were met with at a considerable elevation among the Andes.—Dr. Robinson said that this subject had a bearing not very remote on anemometrical researches; and that the common idea that wind consisted of one steady current of air in one fixed direction required to be considerably modified, as from facts observed by him, when endeavouring to determine the velocity of the wind by firing gunpowder, he found that the direction was frequently wavering back and forwards, and even ascending filaments and currents frequently encountered.

"On the Friction of Water," by R. Rawson, Esq.—The object of this paper is to ascertain the friction of water on a vessel or other floating bodies rolling in water. For this purpose experiments have been made upon a cylindrical model—whose length is thirty inches, diameter twenty-six inches, and weight 255.43 lb. avoirdupois—in the following manner:—The cylinder was placed in a cistern, in the first place, without water, and made to vibrate on knife-edges passing through the axis of the cylinder. A pencil projecting from the model in the direction of the axis of the cylinder on the surface of another moveable cylinder marked out upon paper placed upon this last cylinder the amplitude of each oscillation. The cylinder was deflected over to various angles by means of a weight attached by a string to the arm of a lever fixed to the cylindrical model:—

Angle of Deflexion.	Angle to which the Model vibrated.
22° 30′	22° 24′
22 10	22 6
21 54	21 48
21 36	31 30
&c.	&c.

When the cylinder oscillated, in all circumstances the same as above, except being surrounded by salt water, the amplitude of oscillations was as follows:—

Angle of Deflexion.	Angle to which the Model vibrated.
22° 30′	22° 0′
21 36	21 3
20 48	20 16
&c.	&c.

Clearly showing that the amplitude of vibration when oscillating in water is considerably less than when oscillating without water. In the above instance there is a falling off in the angle of amplitude of 24′, or nearly half of a degree. This amount has been confirmed by several experiments made with great care; and it appears only fair to attribute this decrease in the amplitude of oscillation to the circumstance of the friction of the water on the surface of the cylinder. The amount of force acting on the surface of the cylinder necessary to cause the decrease in the amplitude of oscillation shown by the experiment was calculated; and the author thinks that this amount of force is not equally distributed on the surface of the cylinder. In consequence of this he thought the amount on any particular part might vary as the depth. On this supposition a constant pressure at a unit of depth is assumed. This, multiplied by the depth of any other point of the cylinder immersed in the water, will give the pressure at that point. These forces or moments being summed by integration and equated with the sum of the moments given by the experiments, we shall have the following value of the constant pressure at a unit of depth: .0000469. This constant in another experiment, the weight of the model being 197 lb. avoirdupois, and consequently the part immersed in the water was very different from the other experiment, was .0000452, which differs very little from the former, showing that the hypothesis assumed in the computation is not far from the truth.

"On the Oscillations of Floating Bodies," by R. Rawson, Esq.—This paper had for its object the description of a course of experiments made at Portsmouth Dockyard by Mr. John Fincham, the master shipwright, and the author, with a view to confirm several important formulæ discovered by Prof. Moseley relative to the rolling and pitching motion of vessels. All the experiments, which were made by Admiralty order, confirm the formulæ for determining the amount of force or work done to deflect a floating body in a state of equilibrium through a given angle, and also another formula which determines whether the vessel thus deflected will move slowly or otherwise. The importance of these questions to naval architecture is obvious; and all the experiments we have made show what we believe to be an important practical fact, viz., that when a sudden gust of wind is applied to the sails of a vessel, or any cause which acts constantly during one oscillation, the ultimate amplitude of deflexion will be double the amplitude which the gust of wind will permanently deflect the vessel. In the next part several experiments were made on models of vessels, some of which have been built with a view to ascertain the best form of midship section which will give the easiest rolling motion.

"On Mirage on the Seacoast of Lancashire," by T. Hopkins, Esq.—In this paper Mr. Hopkins represented that he had observed the phenomenon called mirage on certain parts of the seacoast of Lancashire, and had at different times examined the state of the atmosphere in various parts of the shore, but more particularly near Southport. Here he found that whilst the sky was cloudy, apparently threatening rain, evaporation in the air, near the surface of the wet shore, was very active. But at other times, when the sun was shining brightly, evaporation at the same short distance from the surface was checked, or entirely stopped; and at such times mirage might be seen. On the morning of July 9 mirage appeared at a certain distance to the north of the spectator, over the flat sandy shore; and, on examining the state of the locality where the phenomenon had been seen, the following facts were ascertained:—

The temperature on the adjoining dry sand hills was	87°
The temperature on the moist sand of the flat shore	78°.1
The temperature of a dry bulb thermometer in air	65°.5
The temperature of a wet bulb thermometer in air	63°.6
Difference between the two last	1°.9

To account for these facts, Mr. Hopkins said that when mirage appeared the sun was shining brightly, and by his direct rays raised the temperature of the ground considerably, when energetic evaporation from the wet sandy shore took place, which sent much vapour into the atmosphere. The presence of this vapour in the air checked evaporation from the wet bulb thermometer, and prevented it from becoming much cooled; and the wet bulb thermometer at the same time, by the feebleness of its evaporation, proved the existence of the large amount of vapour in the locality. Now, as mirage appeared only when the sun produced a large amount of vapour from the moist surface of the ground, which vapour was shown to be present by the state of the wet bulb thermometer, it is to be inferred that the vapour caused the appearance of mirage. It might be that some of the vapour was condensed by the comparatively cool air at a small distance from the surface of the sand, and thus a stratum of cloud was formed, from the surface of which light was reflected. But, however this may be, the presence of vapour sufficient to saturate, or nearly saturate, the air in the port always accompanied the appearance of the mirage, and, therefore, is presumed to be the cause of it. Objects seen reflected in the mirage were occasionally intensely blue. Objects that were beyond the place where the mirage appeared were reflected by it as if they were reflected by water. Refraction sometimes accompanies mirage, distorting the reflected as well as other objects nearer to the spectator than the mirage; but the refraction is quite a separate phenomenon, sometimes appearing with, and sometimes without, the mirage. Mr. Hopkins exhibited a number of tabulated observations in corroboration of what had been advanced. He also said that recently, at Blackpool, in the middle of the day, with a clear sky and a strong sun, while the dry and wet bulb thermometers on the wet sandy shore were at the same height (70°), there was a difference of 5° between the two instruments on the adjoining cliffs, about sixteen yards high. These facts, Mr. Hopkins contended, proved that while evaporation saturated the air near the surface, and produced mirage, the atmosphere at the height named was comparatively dry, allowing evaporation to take place with considerable energy from the wet bulb thermometer.

"On the Means of Computing the Quantity of Vapour contained in a Vertical Column of the Atmosphere," by T. Hopkins, Esq.—Mr. Hopkins showed that the quantity of aqueous vapour existing in the atmosphere is computed, by me-

teorologists of the present day, from the tension of vapour near the surface of the globe in such a way as would alone be correct if an atmosphere of vapour only existed. But the vapour in our atmosphere is intermixed with, and diffused through, gases,—which gases cool by expansion, consequent on the removal of incumbent pressure, five times as much as the vapour does. The vapour, therefore, produced by evaporation at the surface of the globe, as it passes into the higher regions of the atmospheric space, is cooled and condensed, not by its own law of cooling by expansion, but by the cold of the gases; and the result is that a smaller quantity of vapour remains in the atmospheric column, with a given temperature and dew point at the surface, than there would be in a pure vapour atmosphere, or than is now said to be indicated by the tension of the vapour found at the surface. That tension, he showed, was a consequence, not alone of the pressure of an incumbent column of vapour, but also of the resistance which rising vapour encounters from having to penetrate the gases while expanding upwards into the atmospheric space. As soon as elastic vapour is formed, the surface of the globe becomes the base on which it rests, and from which it is disposed to expand upwards. But the resistance of the gases prevents free expansion, and preserves a certain amount of density of vapour that would not otherwise be so early attained. The tension of vapour, therefore, only measures the degree of density that is thus produced, and does not indicate correctly the quantity that exists in the whole atmospheric column. Tables were exhibited by Mr. Hopkins to show the quantities of vapour—expressed in decimal parts of an inch of mercury—that would exist at different heights to the extent of four thousand yards from the surface, in an atmosphere of pure vapour, and also in our mixed atmosphere, each being at the temperature and dew point of 50° at the surface. And the excess in the quantity of vapour in the former above the latter was stated to show the extent of the error involved in the present mode of estimating the quantity of vapour in a vertical column of the atmosphere with the dew point named—50°.

"On the Heat of the Vaporization of Water," by J. P. Joule.—The object was to point out the complex nature of the heat hitherto taken for the latent heat of steam. In the exact experiments of Regnault 965° was found to be the quantity of heat evolved in the condensation of steam saturated at 212°; of this quantity 75° is the heat due to the vis viva communicated by the pressure of the steam, leaving 890° as the true heat of vaporization of water. In a perfect steam-engine supplied with water at 212°, and worked at atmospheric pressure without expansion, 965° will be the heat communicated from the fire to the boiler, 75° will be the heat utilized by conversion into force, and the remainder 890° will be the heat given out in the condenser.

SECTION B.—CHEMISTRY, INCLUDING ITS APPLICATIONS TO AGRICULTURE AND THE ARTS.

"Researches on the Theory of the principal Phenomena of Photography in the Daguerreotype Process," by A. Claudet.—The various subjects treated by Mr. Claudet were the following:—1st. What is the action of light on the sensitive coating? 2d. How does the mercurial vapour produce the daguerreotype image? 3d. Which are the particular rays of light that impart to the chemical surface the affinity for mercury? 4th. What is the cause of the difference in achromatic lenses between the visual and photogenic foci?—why do they constantly vary? 5th. What are the means of measuring the photogenic rays, and of finding the true focus at which they produce the image? Light produces two different effects on the daguerreotype plate capable of giving an image. By one the surface is decomposed, and the silver is precipitated as a white powder,—this action is very slow. By the other the parts affected by light receive an affinity for the mercurial vapour, and this metal is deposited in white crystals. This action, which is the cause of the daguerreotype image, is 3,000 times more rapid than that producing the decomposition of the surface. After having examined the phenomena of these two actions, Mr. Claudet considers that it is impossible to refer them to the same cause. The first is a chemical decomposition of the surface, and the second is a mere new property imparted to the surface to attract the vapour of mercury, which is given by some particular rays and withdrawn by some other rays. The most refrangible rays produce the affinity for mercury, and the less refrangible withdraw it. Mr. Claudet afterwards explained the principle of his photographometer, and several improvements he has lately made in that instrument, by which he can compose upon the same plate a series of intensities in a geometrical progression, varying from 1 to 512, and when employing two plates at the same moment from 1 to 8192; and by another modification of the instrument he can, by shutting one half of every hole through which the light has affected the plate, and submitting this half to radiation through red, orange, or yellow glasses, he can study the modifications produced on the various intensities of effect by their coloured or insulated radiation. The experiments to which Mr. Claudet refers would be too long to enumerate here; and we shall conclude by alluding to the most important point of this paper—which is the question of the difference between the visual and photogenic foci, and the constant variations they undergo by the influence of unknown causes, at all events, which he has not been able to ascertain. It is known that several years ago Mr. Claudet was the first to point out the difference between the two foci and the necessity for the operator to place exactly the plate at the point where the photogenic focus is produced in order to have a correct daguerreotype image. But the new important fact lately observed by Mr. Claudet refers to the constant variation between the proportionate distance of these two foci. It appears that, according to some causes which Mr. Claudet has not been yet able to discover, the two foci for the same distance of an object are sometimes coinciding and sometimes very far one from the other; and what is most remarkable is that the difference varies according to some properties of the lenses, in such a manner that when the two foci coincide in some lenses they may be very much separated in the other.

Mr. Hunt made some remarks on the peculiar distinctions observed in the phenomena of luminous and chemical action, which led him to infer that they were different in all their phenomena although associated in action.—Dr. Miller stated that he had in pursuing this inquiry been led to observe that the dark bands of the spectrum were extended in a remarkable manner over the space usually regarded as the most actively chemical; and he hence inferred, seeing that the interruptions of chemical action on sensitive surfaces were coincident with the bands observed on turmeric paper, that the chemical action was due to the luminous principle,—that, indeed, there was no difference between the action of light and the principle, which Mr. Hunt was disposed to regard as dissimilar to it.—Mr. Hunt admitted the value of Professor Miller's investigations, but he was at present disposed to regard the facts observed as proving merely that actinism and light obeyed the same laws of motion.—Dr. Daubeny made a few remarks on the unfortunate character of the name adopted to distinguish this chemical principle of the sun's rays.

"Inquiries on some Modifications in the Colouring of Glass by Metallic Oxides," by M. G. Bontemps.—In this communication some important practical points connected with the coloured ornamentation of glass and porcelain were brought forward. In the first place it was shown that all the colours of the prismatic spectrum might be given to glass by the use of the oxide of iron in varying proportions and by the agency of different degrees of heat,—the conclusion of the author being that all the colours are produced in their natural disposition in proportion as you increase the temperature. Similar phenomena were observed with the oxide of manganese. Manganese is employed to give a pink or purple tint to glass, and also to neutralize the slight green given by iron and carbon to glass in its manufacture. If the glass coloured by manganese remains too long in the melting-pot or the annealing-kiln, the purple tint turns first to a light brownish-red, then to yellow, and afterwards to green. White glass in which a small proportion of manganese has been used is liable to become light yellow by exposure to luminous power. This oxide is also in certain window glass disposed to turn pink or purple under the action of the sun's rays. M. Bontemps has found that similar changes take place in the annealing-oven. He has determined, by experiments made by him on polyzonal lenses for M. Fresnal, that light is the agent producing the change mentioned; and the author expresses a doubt whether any change in the oxidization of the metal will explain the photogenic effect. A series of chromatic changes of a similar character were observed with the oxides of copper; the colours being in like manner regulated by the heat to which the glass was exposed. It was found that silver, although with less intensity, exhibited the same phenomena; and gold, although usually employed for the purpose of imparting varieties of red, was found by varying degrees of heating at a high temperature and recasting several times to give a great many tints, varying from blue to pink, red, opaque yellow, and green. Charcoal in excess in a mixture of silica-alkaline glass gives a yellow colour, which is not so bright as the yellow from silver, and this yellow colour may be turned to a dark red by a second fire. The author is disposed to refer these chromatic changes to some modifications of the composing particles rather than to any chemical changes in the materials employed.

Dr. Faraday spoke on the importance in all our inquiries of associating physical and chemical science. In the beautiful facts brought forward by M. Bontemps it appeared that many of the changes of colour mentioned are purely physical. The phenomena of the change of manganese from white to pink in glass appeared to him inexplicable as a chemical effect.—Mr. Dilke inquired upon what peculiarity depended the differences discovered to exist in the coloured glass of the windows of old churches and that of modern manufacture.—M. Bontemps stated that the observed differences were entirely due to age and imperfections in manufacture.—Dr. Faraday remarked that any irregularities tended to produce the diffusion of the rays which permeate the glass; and that the opacity of ancient church windows was probably due to a superficial change of the external surface.—M. Bontemps stated that old glass was by repolishing rendered as transparent as any modern glass.

"Report on the Heat of Combinations," by Dr. Andrews.—Every molecular change in the condition of matter is almost invariably connected with the evolution or absorption of heat; and the quantity of heat thus set free or absorbed bears always a definite relation to the amount of the mechanical or chemical action. To ascertain this relation has been the object of Dr. Andrews in this investigation. The report gives a general view of the actual state of our knowledge on the subject of thermo-chemistry. We cannot condense within the limits of our journal the numerous points of interest involved in this report. They are of the highest scientific interest, and will be published entire in the journal of the association. The following are a few of the principal points:—1. The solution of a salt in water is always accompanied by an absorption of heat. 2. If equal weights of the same salt be dissolved in succession in the same liquid, the heat absorbed will be less on each new addition of salt. 3. The heat absorbed by the solution of a salt in water holding other salts dissolved is generally less than that absorbed by its solution in water. 4. The heat absorbed by the solution of a salt in the dilute mineral acids

is generally greater than that absorbed by its solution in water.—It was further shown by Dr. Andrews that, in reference to the combination of acids and bases, the heat developed during the union is determined by the base, and not by the acid. An equivalent of the same base combined with different acids produces nearly the same quantity of heat. When a neutral salt is converted into an acid salt by combining with one or more equivalents of acid, no disengagement of heat occurs. When a double salt is formed by the union of two neutral salts, no disengagement of heat occurs. When a neutral salt is converted into a basic salt, the combination is accompanied by the disengagement of heat. When solutions of two neutral salts are mixed, and a precipitate formed from their mutual decomposition, there is always a disengagement of heat, which, although not considerable, is perfectly definite in amount. Numerous results illustrative of this point were given. The combinations of metals with acids, and their combustion in oxygen, were then examined. The actions of chlorine, iodine, and bromine were also detailed, and the heat developed by the combination of these bodies with metals shown.

Professor Magnus asked if Dr. Andrews had noticed any difference in the heat of combination of bodies in different allotropic states, as, for instance, the diamond, graphite, and carbon.—Dr. Andrews stated that the diamond disengaged 7,824 units of heat during its combustion in oxygen gas—in the form of graphite, 7,778 units—and in that of wood charcoal, 8,080. It had also been thought that differences had been observed in the heat disengaged in various allotropic states.

"On the Compounds of the Halogens with Phosphorus," by J. H. Gladstone, Ph.D.

"On Artificial Gems," by M. Ebelmen.—This was merely a note accompanying some specimens of artificial gems prepared by M. Ebelmen under the influences of heat and pressure, as described in his communications to the Academy of Sciences of Paris.

"On a New Method of Determining the Organic Matter in Water," by Professor Forchhammer.—The test which he applies is hypermanganesiate of potash or soda, which he prepares in this way. He heats the hydrate of potash or soda with chlorate of potash and the peroxide of manganese, according to the method of Wöhler. After heating, the salt is thrown into water, and so much diluted muriatic acid is added that it assumes a bluish-red colour, upon which carbonic acid gas is let through until the colour has become bright red, and the manganesiate of potash completely converted into hypermanganesiate. The liquid must be cleared, either by allowing it to deposit all the oxide of manganese, or by filtering it through asbestos. This liquid may be kept for a very long time unaltered in a glass vessel with a glass stopper. The next process is to ascertain the strength of the test, which is done by taking any determined measure of it, mixing it with water and a little alcohol, and then heating it. All the manganese is thrown down, and, after being washed and exposed to a strong red heat, it is the compound oxide of manganese, 3 Mn + 4 O. This test is now applied in such a way that, for instance, one pound of the water which is to be tried is mixed with a small quantity of the test and boiled. If the colour has disappeared, another quantity is added, and the liquor again boiled, until, in going on in that way, the red colour of the liquid does not disappear any longer. After that it is allowed to cool, and then the quantity of hypermanganesiate of potash, which has not been decomposed for want of organic matter in the water, is determined by comparing its colour with distilled water; to which have been added very small determined quantities of the test solution. If the quantity of the test which is thus added in excess is subtracted from the whole quantity which has been used, the real quantity of decomposed hypermanganesic acid is determined, and thus also the quantity of organic matter itself. This method is liable to one fault, viz., that the nature of the organic matter may be different, and accordingly require different quantities of the test liquors to be decomposed. But the organic matter which generally occurs in water is approaching almost always to humic acid, and thus the determination of the organic matter allows it to be compared. As to that part of the organic matter in water which contains nitrogen, the author thinks that he has found out a method for determining it by itself; but not having yet finished his experiments on that point he must leave it out of the question. Water taken from a greensand spring about twelve miles from Copenhagen contained so little organic matter that one pound only required six measures of a test solution, of which one hundred measures contained the manganese of 0.526 of the double oxide of manganese; while water taken from a lake which communicates with a peat moss required one pound for seventy-four measures of the same liquor. Professor Forchhammer, continuing for a whole year every week this analysis of the water which is used for supplying Copenhagen, observed the following facts:—1st. The quantity of organic matter is greatest in summer. 2d. It disappears for the most part as soon as the water freezes. 3d. Its quantity is diminished by rain. 4th. Its quantity is diminished if the water has to run a long way in open channels.

Mr. West asked if all organic substances were oxidized by the salt in question. — Professor Forchhammer replied that nitrogenous organic matters occasioned a precipitate by chloride of gold, which precipitate, on analyzing according to the ordinary method, gave ammonia. But whether or not all the nitrogen was thus thrown down he had not yet determined.—Some further conversation ensued, in which Dr. Faraday, Professor Rogers, and Dr. Daubeny took part.

[It might appear from the construction of the sentence in our report of the conversation which ensued upon reading Dr. Scoffern's paper, see page 194, that the galvanic process had been employed in that gentleman's process of refining sugar. We are requested to state that he does not employ it.]

Sir,—Permit me to direct your attention to one portion of your report on my paper read at the British Association,—a portion which, as it stands, would seem to imply a remark of Dr. Faraday adverse to my operation, which was not the case. I was asked by a member, whom I did not recognise, whether I could offer any opinion as to the practicability of removing lead from solutions of sugar by means of the galvanic agency,—not in my process, but in contradistinction to my process. I replied, that a refiner, who had tried this means of removal, informed me it did not answer. Whereupon Dr. Faraday expressed his opinion that the galvanic ageney, however applied to such purpose, never would answer. As the use of voltaic electricity is no part whatever of my process—indeed, is one concerning which my opinions are entirely in accordance with those of Professor Faraday—you will readily see how desirous I am of placing the matter in its true light.

I have, &c.,

J. Scoffern.

Section C.—Geology and Physical Geography.

"On the Distribution of Gold Ore over the Earth's Surface, and on the Structure of California, as compared with that of the Ural Mountains," by Sir R. I. Murchison.—The author exhibited an enlarged Mercator's projection of the world, taken in great part from a general sketch-map, by M. A. Erman, of Berlin, on which all the leading ridges affording gold ore in times past or present were marked, also an enlargement of the map of California by M. Erman, and his own large map of Russia, and sections in the gold district of the Ural. After referring to the works of Humboldt and others, Sir Roderick gave a condensed view of his own observations on the gold region of the Ural Mountains, which had led him to form the opinion that gold veins had generally been produced where certain rocks of intrusive character, viz., greenstones, porphyries, sienite, granites, and serpentines, had been intruded through palæozoic rocks, particularly as respects the Ural, among those of the Silurian epoch. It is, in short, where clay slates, limestones, and greywacke sandstones have been penetrated by such igneous rocks that quartz veins abound, and with them a diffusion of gold ore in grains, leaf and veins. All the phenomena of Siberia to the East of his own observations are lithologically and geologically similar to those of the Ural. To the general view of Baron von Humboldt, that the richest gold deposits are those which are derived from ridges having a meridian direction, M. A. Erman is decidedly opposed; but Sir Roderick is of opinion that, although we may be unable to explain the cause, it is a fact that the greatest quantity of gold ore has been obtained from chains having a nearer relation to north and south than to equatorial or east and west directions, due perhaps to the general form of the chief masses of land, and the prevailing strike of the palæozoic rocks. He next pointed out the error into which some persons had fallen, of supposing that the Uralian mines were worked underground; the only small subterraneous work being one near Ekaterinburg, which affords a very slight profit. All the other mines along that north and south chain, throughout 8° of north latitude, are simple diggings and washings which are made in the detritus or shingle accumulated on the slopes of the ridges and in the adjacent valleys, and, with one exception, are all upon the east side of the range. This phenomenon in the Ural Mountains is a necessary result of their structure; the older deposits through which the eruptive rocks have risen constituting chiefly the crest and eastern slopes of the chain, whilst the western slopes are occupied by deposits of younger or Permian age. As the conglomerates and detritus of the latter rock contain no traces of gold, though they abound in copper ores, it was pointed out in the work on Russia that the auriferous veins were produced after the accumulation of the Permian system. Comparing California with the Ural, Sir Roderick showed that there was a very great coincidence of mineralogical structure, and that with these constants the same results obtained; the chief distinction consisting in the apparently larger proportion of gold in the detritus of the newly-discovered deposits in California than in those of the Ural. He contended, however, against the inference that any large tract of California would be found to be as uniformly auriferous as the banks and slopes of the upper tributaries of the Sacramento. That gold ore has been found from latitude 36° to latitude 40° along the western slope of the Sierra Nevada is admitted, but the longitudinal extension or breadth of the auriferous detritus of California has yet to be ascertained. As, however, the lower or coast ridge which passes by San Francisco seems to be in miniature what the higher parallel mountains are upon a larger scale, in being composed of greenstones, porphyries, greywacke sandstones, and quartz rocks, it is probable that very much of the great intervening valley of the Sacramento may be strewed over at intervals with auriferous debris. And here the author took some pains to indicate the distinctions between all such surface mining operations as those of Siberia, California, and the Brazils, and those works in which, besides the ores of silver, copper, &c., gold also had been extracted from the veins in the solid or parent rock, as in Mexico and many other parts of the world, and in such cases the nobler metal is usually associated with amalgam of other ore, which renders its extraction very costly. In adverting to the remarkable fact, that, when found in superficial detritus, the associated ores of the parent veinstone have disappeared, he accounted for this phenomenon by the oxidation and wear of the other metals, and the resistance of gold and its frequent accompaniment, platinum, to such action, and to their superior weight, which had enabled them to withstand the strong action of former denudation like the quartz veins of the original matrix. Adverting to the facts that in

the Ural Mountains, where little or no admixture with other ores existed, the veinstones "in situ" have proved very slightly remunerative when worked further downwards, he glanced at a view of Humboldt, who, looking to the great lumps or "pepites," occasionally found in the surface rubbish, supposed that there may have been some connection between the production of gold and the atmosphere; since, judging from these specimens, it was from the superficial extremity of these quartz veins that the richest branches of gold must have been derived; the veinstones, when followed downwards, having usually proved unproductive. As, however, there are cases (chiefly on a small scale, as in Hungary) where gold ore continues to ramify in veinstones of great depths beneath the surface, the author contents himself with dwelling upon the important satistical fact, that all the great masses of gold ore have been, and are, derived from superficial rubbish; the major part of this detritus he carefully distinguishes from modern alluvia, and shows that it has been the result of former and more powerful causes of degradation than those now in operation—causes which distributed coarse shingle and blocks and sand, with occasional large lumps of gold, and wearing away all the associated schists, and the most oxidizible ones, left only the harder rocks, particularly the quartz veins, together with the harder, purer, and nobler metals, gold and platinum. The existing rivers have little more to do with this phenomenon than that in mountainous tracts, and where they have a rapid descent, they have laid bare the edge of the previously-formed gold accumulations. By this observation it is not meant to deny that where existing streams flow directly from rocks "in situ," which are now impregnated with gold, auriferous detritus must not naturally be the result, but simply to prevent the student who may refer to detailed maps of gold tracts from imagining that the rivers are auriferous except when they derive that quality from the wearing away and breaking down of the mixed materials which constitute their banks. In a word, British geologists may be assured that gold shingle and sand have been accumulated just in the same manner as the former local drifts of their own country, and that in both bones of mammoths, rhinoceros, and extinct quadrupeds occur. Having terminated his account of the geological constants which accompany gold mines in Europe, Asia, and America, Sir Roderick then traced the history of gold and its development as known to the ancients and our ancestors of the middle ages. He showed that, in all regions where rocks similar to those he had described occured, there gold had been found in more or less quantities, and that just in proportion to the time that a country had been civilized had the extraction and produce of the precious metal diminished; so that in many tracts where it formerly prevailed to some extent it had been either worked out, or the mines have been almost forgotten. Briefly alluding to the examples at home of gold works in Wales under the Romans, where Silurian rocks are pierced by trap and contain veinstones as described by himself, and to the former gold of Scotland and Ireland, and its occasional discovery in the detritus of the county of Wicklow, and its diffusion in some of the oldest strata of Merionethshire, he particularly dwelt on the continental tracts formerly so rich, as cited by Strabo, all of which, with the exception of the north Ural, or country of the Arimaspes, from whence the Scythian ores came, were no longer gold-bearing districts. The Scythian or Uralian tract had, in fact, remained unknown and unattended to from the classical age until this century, and so completely ignorant were the modern Russians of the existence of gold in the Ural Mountains, or that they had in their hands the country which supplied so much gold to Greece and Rome, that excellent German miners had long worked the iron and copper mines of that chain before any gold veins were discovered. These also were worked as solid veins in the rock for some time before the accidental discovery of a small per centage of gold ore in the ancient alluvium or drift led to the superficial diggings, which produced, at an infinitely less expense, ten times the amount of produce of the mines in the solid rock near Ekaterinburg. All the energy displayed by the Russian miners having failed to augment the amount of Uralian gold, and as it has never much exceeded half a million sterling, the period is gradually arriving when the local depressions or basins of auriferous detritus of that region will be successively dug and washed out, and the Ural will then resemble many other countries in possessing actual mines of iron and copper, but merely a history of its gold. Russia, however, has also the golden key of all eastern Siberia, in which various offsets from the Altai chain, and chiefly those which, separating the rivers Lena, Jenisei, &c., stretch along the shores of the Baikal Lake, and have proved so very productive that for some years they have afforded a greater supply of gold (three millions sterling average, exclusive of the Ural) than all the other gold-bearing countries of the world. As in the Ural Mountains, so in California, notwithstanding their keen scent for gold from the days of Columbus to the present time, the Spaniards never knew of its existence in the valley of the Sacramento, which tract they left in quiet possession of the native Indians; and it was only by the recent accident of the breaking away of a bank of detritus by a mill-race that this region was opened out for the first time to the new colonists of the Anglo-Saxon race. What, then, is to be the value and duration of these Californian mines? On the point of absolute value the author does not venture in the absence of sufficient facts and statistical data; but, in regard to the duration of the mining ground of California, he speculates that, if it be locally so much richer than the similarly constituted detritus in the Ural, still there is nothing to interfere with the belief founded on all past experience, that with the activity now employed in the works they may not be neglected or abandoned in a given time. The very great per centage of gold ore in the valleys of the Sacramento seems to indicate that the most valuable portions of the original veins have been ground down by former powerful denuding agencies; and as the rule obtains very greatly in mining that the richer the veins the less are they likely to be spread over a large mass of parent rock, so is he disposed to think that it will only be in certain patches that very great wealth will be discovered, and hence that it would be hasty to conclude that, because rich gold detritus has been discovered near the sources of the Sacrament in lat. 40°, and also on the river Colorado in lat 34° 5′, all the intermediate tract of country (of 4° of lat. and 1° of long.) should prove equally productive. Considering the vast addition in the few last years of nearly four millions sterling per annum made to the European market by the researches in Siberia, and seeing how little effect such addition has produced in the value of gold, the author is of opinion that the Californian discovery is not likely to produce any material disturbance in the standard. At the same time he expresses his full agreement with M. Erman and others, that, with the advancement of colonization in the central regions of North Asia and other parts of the world where civilization has not yet extended, other gold tracts may be discovered wherever the geological and lithological constants to which he has adverted occur; but neither would this circumstance induce him to fear that such discoveries (which can only take place at long intervals of time) will more than compensate for the wear and tear of the precious metal, and supply the wants of the rapidly-increasing population and more highly-advanced state of civilization. Sir Roderick then briefly alluded to the erroneous opinion of old authors that the origin and production of gold had any reference whatever to hot or equatorial climates, as testified by the abundance of ore in Siberia even up to 67° north lat., and cited a table by M. Erman which showed that by far the greatest quantity occurred in northern latitudes, there being every probability, according to that author, that much more of the ore may be discovered in the northern prolongation of the American chains, and in the frozen regions of Russian America, just as he had discovered in ridges of the far north-east of Siberia and near to Kamschatka. He reminded his geological auditors that, in considering the composition of the chief or eastern ridge of Australia and its direction from north to south, he had foretold (as well as Colonel Helmerson, of the Russian Imperial Mines) that gold would be found in it; and he stated that in the last year one gentleman resident in Sydney who had read what he had written and spoken on this point had sent him specimens of gold ore found in the Blue Mountains, whilst from another source he had learned that the parallel north and south ridge in the Adelaide region, which had yielded so much copper, had also given undoubted signs of gold ore. The operation of the English laws by which noble metals lapse to the Crown had induced Sir Roderick Murchison to represent to her Majesty's Secretary of State that no colonists would bestir themselves in gold mining if some clear declaration on the subject were not made; but, as no measures on this head seem to be in contemplation, he infers that the Government may be of opinion that the discovery of any notable quantity of gold might derange the stability and regular industry of a great colony, which eventually must depend upon its agricultural products. A periodic discovery like that in California may, indeed, in the hands of adventurous and unbridled speculators, force a considerable quantity of surface gold so suddenly upon the market that a momentary apprehension of a great change in its relative value may be entertained; but, looking to the mineralogical and geological structure of America, and seeing how large a portion of that continent is made up of rocks precisely similar to those which have afforded the gold shingle and sand of the Sacramento, and knowing that all the other far-famed gold districts of the New World have had assignable limits in their productive capacities, and that many of their sources have disappeared or become valueless, he believes that the time will come when the rich soil of the valleys of California, like that of the banks of the Rhine, the Guadalquivir, and the rivers of Bohemia, will alone be turned up by the plough, or serve as pasture lands, to the entire abandonment of gold-hunting.

The president confirmed the statement of Sir R. Murchison that little advantage had ever been gained by mining the solid rocks containing gold; the deposits from which it was obtained consisted of the detritus of these rocks produced by the action of the sea in former ages; they were not mere river-beds now in process of formation, but portions of that wide-spread drift, containing frequently the bones of the mammoth and other extinct animals, which is found also in this country. He did not consider the evidence conclusive either that there was most gold near the surface of the auriferous rocks, or that the auriferous chains were mostly meridional.—Prof. W. Rogers stated that the position and relations of the gold ore in the United States, occurring principally in Virginia and Carolina, had been ascertained in the course of the Government surveys; the gold was uniformly associated with or imbedded in quartz rock, forming veins in the talcose and micaceous schists and altered sandstones. Gold was once procured there in such abundance and with such facility as to create an interest almost equal to that of California in the public mind. So long as the operations were restricted to washing the detritus of the valleys and principal streams, the produce was abundant and largely repaid the labour; but these comparatively superficial deposits were often very rapidly exhausted from the wasteful mode of conducting the works, and, as soon as mining in the solid rock was attempted, an almost universal destruction of the mining societies took place, producing very extensive disasters, and finally amounting to a serious public calamity. It was probable that this difficulty in obtaining gold by

mining was universal, and continued at all depths; it was partly owing to the association of the gold, in solid rocks, with iron pyrites and ores of copper and lead, so blended as to cause great difficulty and expense in separating them; near the surface of the rocks this proeess seemed to have been accomplished by atmospheric agency, for it was impossible to suppose that the gold was originally most pure and abundant over what is now the surface. From the decomposition of these metallic ores the auriferous quartz of the United States is known as "honeycomb" quartz, or by the miners as "bloom of gold," since it occurs scattered over the surface where the gold-producing veins exist. The general trend of the old metamorphic rocks in the United States is north-east by south-west, and the gold veins conform to this general direction, being frequently interposed between the strata instead of crossing them. Gold had been found at intervals all the way from Lower Canada to Central Georgia, a distance of 1,000 miles, and although insignificant in quantity, as compared with California, it occurred under the same conditions. Prof. Rogers was of opinion that after a few years the amount of gold obtained in California will greatly decline, without having inundated the world to such an extent as the hopes or apprehensions of some have led them to suppose.—Prof. Sedgwick contended that the age of the rocks was not a constant phenomenon in connection with gold, but that the condition of the rocks did appear to be constant; in the Alps, lias and still more modern rocks were seen passing into the condition usually characteristic of the "primitive," but such instances were extremely rare: in this country gold was found in the Devonian rocks of St. Austell as well as in the granite of Shap Fells. Prof. Sedgwick also disputed Humboldt's generalization upon the direction of auriferous chains, which were not generally north and south any more than mountain chains were mostly north and south. He then described the manner in which the tin ore is separated from the alluvial soil in Cornwall, by "jigging," or agitating it in a basket with water, by which the soil is washed away and the heavier ore remains; it was by a similar process, carried on upon a large scale, that nature formed the Californian gold-field; the Sierra Nevada had been agitated beneath the waves of the sea until thousands of feet of solid rock had been broken up, the lighter and more soluble materials carried far away, and the heavy particles of gold spread out with the detritus remaining in the valleys immediately below the hills. Such deposits could not be uniformly rich, and the most productive would probably be the first discovered; there was no fear, however, of obtaining too great a quantity of gold—the population of the world was increasing, and for whatever purposes gold was useful a larger quantity was required. The mode in which it was accumulated in particular countries ought to be considered as much a manifestation of the benevolence of Providence as the accumulation of coal in some countries to the exclusion of others, since, if the existing quantity were diffused over the whole globe, it would be lost beyond recovery, and cease to minister to the use of man.—Sir H. De la Beche also argued that the mineral and physical conditions, rather than the age, of the rock were connected with the accumulation of any particular ore. The tin ore, formerly supposed to be confined to the most ancient rocks, was now known to abound in the equivalents of the coal measures. Gold veins must have been liable to be broken up and redistributed in ancient times as well as more recently, and indeed much of the auriferous pyrite occurred in rocks which had once been mud, the grains of gold forming the nucleus around which the sulphuret of iron had formed. Most of the metallic ores had been deposited in hollows from a state of solution, and in some instances they occurred in isolated cavities, and must have passed through the pores of the rock like the pseudo-morphous crystal of tin in cavities originally occupied by feldspar in the granite of Cornwall. Changes by atmospheric action were known to occur in lodes containing copper ore, metallic copper being found at the back of the lodes, produced by the decomposition of the ore and precipitation of copper, as in the electrotype process—from the same cause carbonate of lead was common at the tops of lead lodes. The case with gold was different; gold could not decomposed or drift far, and must sink down amongst the detritus of the original rocks and remain near the shore. He considered that the fact of gold being most abundant in the older rocks was owing to the fact of those being the rocks most frequently in the requisite mineral and physical conditions.—Mr. C. Darwin stated that he had visited a gold mine on the east side of the Cordillera, in rocks much newer than the Neocomian series; the mines were poor, but the comparatively modern origin of the rocks was indubitable.—Sir R. Murchison, in reply, observed that he believed all rich gold veins were confined to the older palæozoic rocks, but his observations did not relate to the occurrence of minute quantities.

SECTION G.*—MECHANICAL SCIENCE.

"On the Cause and Prevention of the Oscillation of Locomotive Engines upon Railways," by Mr. Heaton.—Mr. Heaton exhibited and described a machine illustrating the subject; and, in a discussion which followed the reading of his paper, and in which the president and Mr. Roberts took part, an opinion was generally expressed that with some modifications Mr. Heaton's plan was likely to answer the object which he had in view.

"On a Patent Water-Meter," by Mr. W. Parkinson.—He described the advantages of his system and arrangement to be:—1. An uninterrupted and instantaneous supply. 2. Equity between buyer and seller. 3. All annoyance from frost and occasional short supply is avoided, as the pipes may be laid internally. 4. In new buildings the meter will be found cheaper than the old cistern. 5. Durability of the meter, which may be fairly reekoned to last twenty-five and thirty years when properly fixed in an elevated situation free from damp, dust, and injury.

"On a Machine for Forming Moulding out of Sheet Metal," by Mr. Roberts.—The purport of this paper could not be explained without the aid of diagrams.

"On a Desiccating Process," by Mr. Davison. Mr. Davison stated that all other methods of drying consist in generating heat by simple radiation, or throwing off heat from a heated surface, whether the surface be brick flues, cockles, steam, or hot-water pipes. Heat, he said, is easily attainable in this way, and to almost any grade of temperature; but heat is not the only essential for drying, or why does the bleacher or laundress hang out their articles to dry on a cold March morning? It is true that heat facilitates the evaporation of the watery particles; but a current is likewise necessary, otherwise all the water which is thus converted into vapour will only tend to charge the chamber with steam, and it is not until this steam has arrived at a certain excess or pressure that it will make its escape, and the operation of drying really commences. The amount of current obtainable in this way is proportioned to the rarefaction and quantity of air admitted and allowed to come in contact with the heated medium. If little is admitted there is little current, an increased temperature, and likewise an increased volume of vapour; or *vice versâ*, if a larger amount of atmospheric air is admitted, there will be a corresponding increased current, a lessened temperature, and much less vapour. The ordinary current obtainable in this way may be taken at three or four feet per second. To subject any article to a slow current of heat in a comparatively close chamber, or where there is an exceedingly small aperture for the escape of vapour whereby that article (whatever it may be) is enveloped in an atmosphere of its own steam, is (to give it its proper name) not drying but stewing. If there is next to no escape at all, as in the case of an oven, it is in reality baking. Mr. Davison stated that it is not only a moving but a rapid current which is the great desideratum for all drying purposes; and that it is the impulsion of atmospheric air, at the velocity of the hurricane or upwards of a hundred miles an hour (or any other speed), combined with the element of heat under perfect control, which, in a few sentences, constitutes his desiccating process. Mr. Davison proceeded to describe the means by which the two operations of current and heat are created and kept up, and some applications which have been made of the process, together with the practical results.

The president expressed his opinion of the high state of perfection to which Mr. Davison had brought his plan, and intimated that if he could go on economizing it he believed its use would become universal.

"On the Manufacture of the Finer Irons and Steel, as applied to Gun-barrels, Swords, and Railway Axles," by W. Greener.—The first innovation on the old principle of manufacturing gun-barrels entirely from old horse-nail stubs was due to the late Mr. Adams, of Wednesbury, who brought out what is termed Damascus iron, which is constructed of alternate layers of steel and iron faggotted, drawn down into rods, then tortuously twisted, and when welded into barrels forms the Damascus barrel. The success of this experiment, both in point of beauty and strength, was so great as to be under estimated at fifty per cent. as compared with the strength of stub-twist iron. The next experiment was to blend more intimately than the above steel with the horse-nail stubs in the proportion of one to two of the latter. The paper described the mode of this; and then went on to narrate that the next and most important improvement in metals was the manufacture of gun-barrels from scrap steel entirely, and for this purpose old coach-wheels were generally in request. By clipping these into pieces, perfectly cleansing them, and welding in an air furnace, a metal is produced which surpasses in tenacity, tenuity, and density, any fibrous metal ever before produced. The tenacity of it when subjected to torsion in a chain testing machine is as 8 to 2½ over that of the old stub-twist mixture. The perfect safety of barrels produced from it is astonishing; no gunpowder yet tried has power to burst them when properly manufactured. These experiments had induced others on a more extensive scale; to effect this, ingots of cast steel were taken from the mill made to No. 3 in the scale of carbonization. These, after rolling into flat bars, were clipped into small pieces, immediately mixed and welded as before in the air furnace, drawn down into rolls, and re-faggotted; these were subsequently drawn down, and were then ready for being made into gun-barrels, either with or without spirally twisting them; to form Damascene barrels from this was perfectly safe—this was ascertained by experiments. It was discovered that the density and tenacity of the metal were sufficiently great to effectually resist the enormous force of this great cast of gunpowder. The manufacture of swords was another article to which this improvement applied. All the investigations of the writer had tended to satisfy him that the Arabs thus produced their finely-tempered Damascus swords; namely, using two steels of different carbonization—mixing them in the most intimate manner, and twisting them many fantastic ways, but observing method in that fancy; and it was a fact that no European sword has ever yet been produced equal to the Damascus. The Government inspector of small arms was of opinion that the swords made in Birmingham were not fit to be used in the army. The writer's investigations had satisfied him that tempering by crystallizing the steel—that is to say, tempering in the ordinary way—was far from the wisest. The Damascus blade in its fibrous state or hammer-hardened is more difficult to break by 100 per cent. than the best English-made blade. This

* We omit sections D, E, and F.

had been tried; but temper it in the same way, and it showed no greater tenacity than our own; the Damascene figure was destroyed by the carbon beeoming equally diffused; nor would aeid develop it—it was entirely gone. From these and other facts the conelusion might be drawn that swords constructed of dissimilar steels—tempered by condensation of its fibres—either by repeated rollings, hammering, or many other processes, which our perfect machinery gave us the faeility to do—are the best. Therefore in time we might hope to see every soldier of the empire armed with a weapon as good, if not so costly, as the highly-prized Damascene.—The remaining part of the paper referred to a subject already mueh discussed—the manufacture of railway axles.

"On the Present State of Electro-Telegraphic Communieation in England, Prussia, and Ameriea," by Mr. Whishaw.—Mr. Whishaw stated that the objeet of his present eommunication was not to bring before the section the numerous telegraphic instruments now in use and reeently made publie; but to point out the advantages and disadvantages of the three great systems of electric telegraphs now in operation in England, Prussia, and America. In England the wires, being suspended from post to post along the sides of railways, are exposed to the following disadvantages—running of trains off the lines, by whieh posts and wires are carried away together, and thus the communieation is stopped. Secondly, from atmospheric influences, whereby irregular and uncertain deflections of the needles in Cooke and Wheatstone's telegraphic instruments took place, besides occasional declination to parts of the instruments, &c. Thirdly, from snow-storms, as in the case of the South-Eastern telegraph which oecurred during the last winter, when the wires and posts were all removed, and considerable interruption was eaused in the transmission of eommunieations. Fourthly, from damage by malicious persons, who sometimes twist the wires together; and for whose apprehension rewards have frequently been offered by the English companies. Fifthly, the wires have sometimes been connected together by a fine wire nicely soldered to the line wires, and thus the communications have been diverted from their right channel. Sixthly, the expense, viz., £150 a mile, for the above-ground system, with an annual expenditure for repairs. Seventhly, and consequently, heavy charges for the transmission of messages. Eighthly, the time required in learning perfeetly the manipulations of the needle telegraph, so that, if a telegraphist is from any cause disabled, there is no one at hand to take his place. With regard to the charges, the following facts will suffice to show the advantages of economical telegraphs. In Ameriea the eharge for twenty words transmitted by the telegraph to the distance of 500 miles is but 4s.; whereas by the English company's charges the same communieation would only be transmitted 60 miles, or less than one eighth the distance,—and by the South-Eastern Company's charges not 20 miles, or one twenty-fifth of the 500 miles. Again, a communieation of ninety words in Ameriea may be transmitted from Washington to New Orleans, 1,716 miles, for 41s. 8d.; whereas by the Eleetric Telegraph Company's charges it would only be transmitted a little more than 200 miles,—and by the South-Eastern Company's scale under 100 miles. The extent of telegraphs in Great Britain at present is about 2,000 miles; and there yet remain railways to an equal extent without telegraphs. Mr. Whishaw expressed a hope that within a short time every principal town in the kingdom would be connected by telegraph, as the underground system may be effected without the aid of railways, viz., under turnpike roads and towing paths, &e. This plan has been practically carried out in Prussia, where at the present time there are 319 German miles = 1492.92 English miles in actual operation. A single wire coated with gutta percha is laid under the railway at a depth of two feet, and connected with the instruments and batteries at the different stations. A colloquial and also a printing telegraph are used in each principal station—both worked as required by the single wire. The experiment as to burying the gutta percha wire in the ground was commenced some years ago, and, being found to answer perfeetly, the Prussian telegraph commissioner appointed in 1844 determined on adopting the underground plan entirely for the Government telegraphs, and which were commenced in July, 1848, so that no time has been lost in carrying them out. At Oderbay the Prussian system is in connection with the telegraphic line now in course of eonstruction between that plaee and Trieste viâ Vienna; and as regards the Prussian Government telegraphs, the public has the advantage of them by payment of certain fixed rates. The cost of the Prussian system is under £40 a mile. The Ameriean system is remarkable for the great extent to whieh it is already earried, viz., 10,511 miles, costing less than £20 a mile. It consists of a single iron wire supported from post to post, but is carried far beyond the limits of railways, and is consequently frequently damaged, so that a code of rules is established for the repair of the wires, which is undertaken by gentlemen living along the lines, and who are furnished with a set of tools for the purpose—their reward being the free use of the telegraphs for their own private eommunications. The economy of first eost, however, causes a very low tariff for the transmission of communications, so that the poorest person is enabled for a few eents to send a communieation to a considerable distanee. From the aetual operations of the three systems, it appears that the Prussian is the most simple, effective, and economical—for annual repairs are not required to the line wires, as in the cases of England and America, where they are exposed to so many casualties.

Mr. Flanaghan, of Kentucky, made some observations respeeting the mode of repairing and keeping in repair the telegraphs in America.

"On a Machine for Ventilating Coal-mines," by Mr. Brunton.—The paper referred to a kind of exhausting ventilator, invented by Mr. Brunton,

"On a Calculating Instrument," by Mr. H. Knight.—The inventor of the maehines exhibited is a Mr. Slonimski, of Byalystock, in Poland. The first instrument submitted to the notice of the section was one for performing the arithmetical proeesses of addition and of subtraction. It consists of a thin box of wood or metal, covered by a plate of metal, in which are perforated a convenient number of eircular apertures and openings, around whieh are engraved or marked the several figures or digits 0 to 9, and behind which are indented plates or wheels, having in eaeh a suitable number of teeth, some of which are shaded, or black, the others being left elear or white. A small pointer, or style, is furnished with the instrument, for the purpose of turning round the indented plates or wheels, by inserting the instrument between two contiguous teeth, and moving it in the required direction. The style is required to be inserted between those two teeth whieh appear under the particular figure engraved on the plate, whieh eorresponds with the number required to be added or subtracted. One general rule being to be attended to, viz., that, if the style be placed between two clear or white teeth, it must be turned to the extreme right hand of the circular opening; but, if between two dark teeth, it must be turned to the extreme left-hand end thereof. The upper part of the instrument is to be used for addition, and the lower part for subtraction, as engraved thereon. The multiplication instrument consists of a rectangular box, about 15 in. square and 3 in. deep. It contains cylinders having printed tables of figures on the circumferenee of eaeh, which cylinders revolve separately, by means of the knobs at the bottom of the box; and by other knobs the upper part of each cylinder is moveable in a vertical direction also,—the rotative and the vertical motions being regulated by figures termed indices, that appear through small holes over the axes of the cylinders. In addition to the index holes, there are nine other rows of holes, on the surface plate of the instrument,—the lower row of holes being for the multiplicand, and the corresponding rows of holes above it to exhibit the products of that multiplicand by each of the nine digits; and these products are produced almost immediately, and without requiring any mental effort. The horizontal number of holes in this instrument is eight; and it is, therefore, calculated to give the product of any number having seven places of figures, or to millions, whatever may be the order of those figures.—This instrument is the result of a new theorem of figures discovered by Mr. Slonimski.

After Mr. Knight had submitted his models, several gentlemen expressed an opinion that an instrument of a similar charaeter had already been notieed in the columns of the *Athenæum*.—Mr. Knight, however, declared that the one alluded to was of a very different character.

"On a new Rotary Engine," by Professor M'Gauley.—This paper could not be properly explained without the diagrams.

WRIGHT'S PATENT STEAM GENERATOR.

On the 8th instant we were present at an experiment performed on the scale of actual practiee with a new description of steam-boiler, which, under the name of Wright's patent steam generator, has recently been brought under the consideration of engineers and scientific men. This machine is conducted upon a principle essentially new, as regards the material arrangement, to which its effieacy is mainly attributable, though not altogether so in other respeets; and the experiment of Saturday last fully established the vaporizing power whieh is claimed for it, that of evaporating twelve pounds of water with one pound of coal, in one hour,—an amount of evaporation which exceeds by fifty per cent. the results obtained with the best arrangements hitherto in use.

If water be boiled in a strong close vessel, from which the vapour cannot escape, the process of vaporization at length stops, because, by the accumulation of vapour above the surface of the fluid, so great a pressure is exerted upon it that beyond a certain point no more can be given out. In this state the water will receive any amount of heat which may be communieated to it, the only limit being the strength of the eontaining vessel to resist the enormous pressure from within. In this way Perkins produced the extraordinary phenomenon of red-hot water, and elicited also some curious properties of water when raised to a very high temperature, whieh he afterwards applied in his steam-gun, where a small quantity of the highly-heated fluid flashed out immediately into a large volume of fine vapour. Another principle or property of boiling water, investigated originally by the ingenious Count Rumford, is involved in the construction of this apparatus. If a long pipe be so bent as to have many folds of it plaeed in the fire, the upper end ascending to a certain height above it, and then returning down to join the other extremity, and the whole pipe be exaetly filled with water, this phenomenon will take plaee. The heated particles of the water near the fire will ascend into the upper parts of the tube, in consequenee of their specific gravity having become diminished by expansion, and they will invariably aseend up that limb of the tube which leads from the top of the folds, because this part of the apparatus is necessarily the warmer. Having ascended, they make room for other particles in the colder branch of the tube, which immediately supply their place in the folds underneath by mere hydrostatic pressure. The place of the latter is in turn filled up by others displaced at the top of the apparatus, when the heated particles arrive there on the other side.

The construction of Wright's boiler will be

easily comprehended, as it proceeds upon the application of these facts. Its principal feature is a cellular arrangement, or system of tubes made of malleable east iron, which, in a "waggon-boiler," such as was experimented upon, consists of six pipes the length of the boiler, laid horizontally, three above the bottom of the boiler, and three below it. Each pipe above communicates at both ends with the one immediately underneath, by short joint-pieces, secured tightly to them by flanges and screws. The pairs thus coupled communicate freely with each other by a number of other tubes of the same material, but smaller in diameter, which form a kind of roof with the large longitudinal pipes within and without the boiler, corresponding to the form of the bottom of the boiler. Into this large tubular vessel, as it may be termed (for being everywhere tight at great pressure it is in fact such), water is pumped in by means of a small hydraulic press until it acquires a pressure of about 400 pounds on the square inch. The tubes, as we before observed, are made of malleable east iron, that is, iron from which a portion of its carbon has been extracted, which enables it to resist a vastly greater rending power, and, consequently, to stand the enormous pressure of the fluid within them, which amounts to many tons. Their small diameter, the material of which they are made, and their free communication with a properly-loaded safety-valve, ensure their proper action at all times and under all circumstances.

The whole of this apparatus is fixed lightly into the boiler, so that there is free communication throughout the tubes, both inside and out, but none between the tubes and the boiler. Water being placed in the boiler at the proper level, the fire is lighted, and the process goes on in this way. The fire plays upon the bottom of the boiler, after passing through the interstices between the tubes, and the remaining caloric passes over the bridge to the remote end. The insulated water contained within the tubes is now in precisely the same condition as that in the red-hot water experiment; because, being everywhere close and under great pressure, it will take up a large amount of heat, and under ordinary circumstances will acquire a temperature of 400 or 500 degrees, without altering its fluid character. The phenomenon mentioned in the second experiment now takes place, the heated water rising to the tubes inside the boiler, where the heat is immediately radiated, or communicated to the great mass of water outside. As the water is heated in the boiler it rises to the surface, and becomes vapour, the colder portion of it coming successively to the tubes, and abstracting the caloric which they convey there. Meanwhile a continual circulation is going on within the tubes by the rising of the heated particles, and they return as cold particles after having parted with their caloric. Thus everything goes on in an harmonious and continual repetition of the phenomena, which are obviously susceptible of the nicest adjustment. Scarcely any leakage can take place in the tubes, because, being constantly closed, no steam can form within them; but in any case a stroke of the pump restores the original pressure of the water within them when in the course of time it becomes diminished. This, with the exception of one or two details relating to secondary portions of the process, is the whole of Mr. Wright's system—a system which is certainly extremely simple, but worthy, on that very account, of an explanation connecting it with those scientific principles upon which its construction has been conducted.

The experiment on Saturday was commenced at 12h. 47m., when 56lb. of best engine coal, weighed with great nicety, was thrown into the furnace, the working temperature of the water in the boiler being 201° Fahrenheit. When the coals were deemed to have done their work, the indications of the water-gauge were taken, from which it was calculated that in the space of 2h. 12m. the machine, with 56lb. of coals, had vaporized 720lb. of water at the temperature of 201° Fahrenheit. The work done by one pound of coal, therefore, was the conversion into steam of 12.86 pounds of water; so that, although the size of the boiler was a four-horse, it was enabled by this ingenious and simple arrangement to do the work of a seven-horse. The uniformity of the result at every experiment is a curious coincidence. It was performed the other day before Mr. Gooch, the superintendent of the London and South-Western Railway, with precisely the same result.

It is scarcely necessary to add that the system is equally applicable to every kind of boiling or evaporation, and in breweries, distilleries, and all businesses where large quantities of liquid require to be boiled or heated, the value of the new system is equally evident.—*Patent Journal.*

STATEMENT IN CONTINUATION OF THE ONE PUBLISHED IN THE CHEMICAL TIMES OF SEPT. 22, 1849, SHOWING THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE AIR FROM SEPT. 16 TO SEPT. 22 INCLUSIVE, AS INDICATED BY THE EVAPORATION OF WATER FROM TWO COPPER VESSELS OR SCALES, ONE INSULATED AND THE OTHER NOT. ALSO THE READING OF THE BAROMETER, THERMOMETER, DIRECTION OF WIND, AND GENERAL STATE OF THE WEATHER.

Sept., 1849.	Barometer.		Therm.		Scales.				Wind.		General state of weather.
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Insulated	Non-Insulated	Morning.	Evening.	
16	30.12	30.18	60	61	20 N.	..	..	20	SW.	NW.	Overcast generally all day.
17	30.30	30.35	59	55	..	..	..	..	NE.	N.	Fine all day, and evaporation good.
18	30.34	30.40	55	52	5 I.	..	5	..	NE.	NE.	Fine all day.
19	30.45	30.47	55	52	..	..	..	..	NE.	NE.	Fine all day.
20	30.43	30.30	55	55	5 I.	10 N.	5	10	NE.	NE.	Fine all day, but rather cloudy.
21	30.18	30.13	55	59	..	..	..	..	E.	SE.	Generally fine all day, with slight showers; clouds of every hue from black to white.
22	30.10	30.05	60	61	..	10 N.	..	10	E.	E.	Fine all day, but cloudy evening.

The above figures, afforded by the scales, although not alarming, do not give any great prospect of a speedy retreat of the cholera, and so far this week the testimony is not of a more cheering character.

Westminster-road, Sept. 25, 1849.

Franklin Coxworthy, Author of "Electrical Condition," &c.

FRANKLIN COXWORTHY'S DISCOVERIES IN NATURAL PHILOSOPHY.

[*Continued from page* 183.]

In our previous investigations of the phenomena connected with combustion, respiration, and the decay of vegetable matter, as far as regards the evolution of the gases, and their restoration to the atmosphere and the vegetable kingdom, we ought to have observed, as being also opposed to the doctrine of diffusion (the fallacies of which cannot be too forcibly urged), that the bulk of the nitrogen liberated by combustion is set free in the cold latitudes, wherein the greatest degree and amount of artificial heat must obviously be required; whilst, on the other hand, the oxygen necessary for the reformation of air, under the hypothesis of diffusion, is principally thrown off within the tropics, wherein vegetation is most luxuriant, which conditions we can scarcely suppose to have been intended by the Creator, if these gases were required to enter into combination on their escape respectively from the chimneys of Northern Europe and the jungles or forests of Central Asia or Africa.

We now enter upon the consideration of a series of deductions which, apart from philosophical inquiry, are fraught with more importance to the pecuniary and physical condition of society than, we believe, any other that may engage the attention of mankind. They are the conditions of heat and cold—the cohesive agent by which matter is held together—and the cause of gravitation.

The first of these subjects has long engaged the attention of the scientific world. An immense number of works have been written, and a proportionate number of theories propounded, to account for the phenomena of heat; yet no satisfactory elucidation of the question has been made. The prevailing doctrine, however, at present entertained is that heat is identical with electricity, and is contained, in matter, in a latent state; the capacity of the matter for the latent heat being determined by the sensible heat, or caloric, evolved during combustion and other chemical action.

With the doctrine of the diffusion of gases the scientific men of the present day appear generally to have concurred; for, although the possibility of the atmosphere being a chemical compound has, on more than one occasion, been surmised, the regeneration of air under that hypothesis, and the existing ideas respecting meteorology, have presented an insuperable barrier to its reception. In treating, therefore, of diffusion, the onus of bringing its manifold absurdities to light has devolved upon us as advocates of the more simple and sensible proposition of Franklin Coxworthy. Such, however, is not the case with the doctrine of latent heat, which has had pretty well as many assailants as supporters. Many eminent philosophers, and among them Sir Humphry Davy, have doubted the separate entity of calorific matter, and have referred the phenomenon to the vibratory or intestine motion of the particles of common matter. They very properly adduce, as opposed to the doctrine of latent heat, the violent heat produced

by the explosion of gunpowder, whereby so large a portion of aëriform matter is disengaged; and the fire which appears in the euchlorine gas, or protoxide of chlorine. The resulting gases occupy a greater space, instead of a smaller one, which latter they should do if the doctrine were correct, since, during expansion, heat should be absorbed and not evolved, and cold, therefore, be produced. But, on the other hand, the reception of this second hypothesis must require a power of conception beyond the faculties of the human mind. Our province, however, is not to expose the fallacies of existing doctrines beyond the removal of such obstruction as they may offer to the reception of rational and sustainable principles. And this we cannot do better than by showing the difficulties that have hitherto existed in rendering natural phenomena intelligible. We do not say that Sir Humphry Davy has succeeded in so doing with reference to his own doctrine. However clear it might have appeared to himself, we apprehend that the reader will not readily comprehend his meaning. And yet it would seem to the uninitiated a very easy process to describe all that pertains to what is called a simple element. Sir Humphry Davy thus describes his theory of heat:—

"It seems possible to account for all the phenomena of heat, if it be supposed that in solids the particles are in a constant state of vibratory motion, the particles of the hottest bodies moving with the greatest velocity, and through the greatest space; that in liquids and elastic fluids, besides the vibratory motion, which must be conceived greatest in the last, the particles have a motion round their own axes with different velocities, the particles of elastic fluids moving with the greatest quickness; and that in ethereal substances the particles move round their own axes, and separate from each other, penetrating in right lines through space. Temperature may be conceived to depend upon the velocity of the vibrations; increase of capacity on the motion being performed in greater space; and the diminution of temperature, during the conversion of solids into fluids or gases, may be explained on the idea of the loss of vibratory motion, in consequence of the revolution of particles round their axes at the moment when the body becomes liquid or aëriform; or from the loss of rapidity of vibration in consequence of the motion of the particles through greater space."

Sir William Herschel and Sir H. Englefield oppose to this doctrine the result of their experiments on the calorific rays which accompany those of light in the solar beams. And Dr. Ure, concluding an elaborate article on this important subject, observes, "Enough has now been said to show how little room there is to pronounce dogmatic decisions on the abstract nature of heat." We concur in that remark; and, as in this branch of natural philosophy judgment may be said to be suspended, since the highest authorities are at issue upon it, no apology is necessary for our offering to the consideration of our readers a system which, if it does not explain the abstruser portions of the subject, will so far simplify it as to render intelligible all the more immediate phenomena.

THE HEALTH OF LONDON DURING THE WEEK.

[From the Registrar-General's Return.]

The mortality from cholera has rapidly declined. The deaths from all causes registered in London in the three weeks ending September 22 were 3,160, 2,842, and 1,981. The decrease has been exclusively in the cholera deaths, which were 2,026, 1,682, and 839 in the three weeks. The deaths from cholera, which in the first week of September were 300 and 400 a day, fell on the 19th to 110, and have since not exceeded 123.

The facts which have been published in detail will, it is believed, be found useful contributions to the natural history of the epidemic. They will show the regular course of the disease through a vast city population; the influence of sex, age, profession, and locality, and a great variety of circumstances on its mortality. It may be useful to point out now the remarkable effects of locality on the fatality of the epidemic, although the proportions may yet be altered by subsequent deaths.

London is divided into thirty-six districts for registration purposes, and the districts are subdivided into 135 sub-districts. The population was enumerated in 1841, and the nearest approximation that can be easily given to the actual population is obtained by assuming that the population increased in 1841-9 at the same rate as from 1831 to 1841. Dividing the deaths from cholera in the thirteen weeks ending September 15, 1849, by the population thus estimated, the following results are arrived at, and cannot be far from the truth:—

More than 5 in 1,000 of the inhabitants of London died of cholera; the more accurate proportion was 53 in 10,000 inhabitants. From all causes the mortality was 116; a rate which is equivalent to an annual rate of 4.64 per cent.

35 in 10,000 of the inhabitants of the north side of the Thames died of cholera.

104 in 10,000 of the inhabitants on the south side of the Thames died of cholera.

The mortality was, therefore, three times as great on the south as it was on the north side of the river.

Taking 10,000 inhabitants as the basis of comparison in each district, the mortality ranged from 8 in Hampstead to 225 in Rotherhithe.

The large north districts extend from the Edgware-road to the river Lea; the mortality was, for Marylebone, 15; St. Pancras, 17; Islington, 20; Hackney, 15. The mortality of Marylebone and St. Pancras is slightly raised by the Middlesex and University College Hospitals. Some cholera patients were sent out of Islington to the Free Hospital in St. Pancras, where their deaths were registered.

The middle districts, extending in a curve from Kensington to Bethnal-green, present generally a much higher rate of mortality; yet there are remarkable exceptions. The mortality in Kensington district, including Paddington and Fulham, was 19; St. James, Westminster, only 12; St. Giles, 48; Holborn, 28; Clerkenwell, 15 (5 less than Islington); St. Luke, 30; Shoreditch, 65; Bethnal-green, 75. St. James, Westminster, is a wealthy parish; the houses were rated at £69, on an average, in 1841. The Rookery and other bad streets contributed among other things to raise the mortality of St. Giles district to 48. Clerkenwell, extending across the higher part of the New-road to Pentonville, has lost only 15 in 10,000; St. Luke double the proportion. The rated value of the houses, and probably the income of the inhabitants, diminish rapidly in passing from the west to the east parts of London. The average rating of the houses in 1841 was—for St. James, Westminster, £69; St. Giles, £48; Holborn, £30; St. Luke, £28; Shoreditch, £13; Bethnal-green, £8. The two last districts are poor, and badly drained. Some of the deaths registered in Shoreditch, in a certain sense, belong and have been counted to the district of St. Luke, whose workhouse is in Shoreditch.

The river-side districts of the north present a higher rate of mortality from cholera than the corresponding districts of the middle and outside range. Chelsea lost 42 in 10,000 inhabitants Kensington, we have seen, 19; St. George, Hanover-square, extending from Oxford-street to the river, lost only 14 in 10,000; and 71 out of the 106 deaths were in the Belgrave sub-district. The mortality (57) was high with less than half the population in the low Westminster district; St. Martin-in-the-Fields and the Strand districts, rising fast from the banks of the river, lost 27 and 31 in 10,000; the city of London within the walls, 33; the London city, east district, 38; the west district, traversed by the Fleet ditch, 70, or 128, accordingly as we include or exclude the deaths in St. Bartholomew's Hospital. At the close of the epidemic these deaths may be distributed over the districts from which the patients were brought; in the mean time, the mortality of the City from cholera must lie between 43 and 57. Whitechapel lost 50; St. George-in-the-East, Stepney, and Poplar, 35, 40, 67, the mortality here being inversely as the density of the population.

Opposite the City and Whitechapel lie, on the other side the Thames, St. Saviour, St. Olave, and St. George, Southwark, where the mortality was 141, 151, 142; further east the mortality rises to 163 in Bermondsey; and in Rotherhithe, intersected by stagnant water, reaches the maximum 225 in 10,000, or $2\frac{1}{4}$ per cent. It will be observed that on the north bank, opposite Bermondsey and Rotherhithe, the deaths from cholera were only 35 and 40 in 10,000, yet the ordinary rate of mortality in St. George-in-the-East is 2.89 and of Rotherhithe 2.77 per cent. The mortality of Greenwich, including Deptford and Woolwich, was 61 in 10,000; Camberwell and Newington 88 and 125, less than the mortality of districts on the south river side, but much higher than even Shoreditch and Bethnal-green. The Lambeth district extends from the Thames to Norwood; over this great area and population the average mortality was 97 in 10,000. The mortality from cholera of the river-side parts of Lambeth is as high as the mortality of St. Saviour, St. Olave, &c. The parts on the south side of the river where the cholera has prevailed with so much violence are below the Trinity high-water mark. At Norwood there were only two deaths by cholera; at Dulwich, in Camberwell district, none; at Eltham, three; Sydenham, five, in Lewisham district; so that the mortality from cholera on the high ground, and in the outer districts of Surrey on the south side of the Thames, was as low as in Hampstead, Kentish-town, Stoke Newington, and Stamford-hill.

The physical causes of cholera, or rather of the mortality of cholera, may now be investigated in the soil, atmosphere, and people of the several districts of London.

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THE CHEMICAL TIMES.

SATURDAY, SEPTEMBER 29, 1849.

SANITARY IMPROVEMENTS AND THE BOARD OF HEALTH.

We are told that "henceforward the first engineers of the country will be employed to lay the rivers under contribution;" that "there will be in every house a spring of fresh, filtered, living water;" that "the bodies of the dead will in future be decently interred in distant grounds and sacred groves;" that "the carnage of slaughtered animals will no longer be suffered to infect the air of cities;" that "sinks, drains, cesspools, and sewers will no longer be permitted to open under our faces;" and that "the deadly emanations arising from these hotbeds of corruption will in future be either decomposed by fire (?), or else made to ascend with the smoke over the houses."

These, if carried out, even were it only to the extent of one tithe of the promise, would, indeed, be sanitary improvements of the very highest order and importance, and such as might

almost induce us to look upon the present visitation as a "most beneficial" affliction. Unfortunately there is but too much reason to fear that these bright visions are not quite so near realization as the Registrar-General assumes them to be. To combat with anything like success the gigantic nuisances of intramural interments, slaughter-houses, bone-boilers' yards, &c., would require a body of earnest, energetic, and thoroughly competent men, acting together in perfect unison and harmony, a body, in fact, the very reverse of the present miserable simulaires of authority that style themselves the "Board of Health" and "Commissioners of Sewers," who manifest their official existence almost exclusively by the occasional publication of long and tedious notifications and reports, unrelieved by a single practical or practicable suggestion; whose meetings but too frequently bear the strongest resemblance to a village school in the absence of the master, and terminate almost invariably in wrangling and personal squabbles; whose highest attempted flight at sanitary improvement has hitherto been the temporary closing of a few churchyards; and who, now that the pestilence which for a time threatened to shake them out of their favourite "*laissez aller, laissez faire*" system is kindly departing of its own accord, seem already on the point of relapsing altogether into their original listlessness. Are these the bodies that are to re-enact the ancient Roman law, "Hominem mortuum in urbe ne sepelito neve urito;" that are to supply every house with a "spring of fresh, filtered, living water;" that are to grapple with the corporation of London, and bid the Smithfield-maket nuisance cease to exist; that are to solve the great and most difficult problem of an efficient drainage and sewerage for our overgrown metropolis? Nay, nay; we expect nothing of the kind from the Ashleys, the Chadwicks, the Southwood Smiths, *et hoc genus omne* of charlatans and quacks. If the sanitary question be left to be dealt with by the "talent, knowledge, experience, energy, and resolution" of these men, we are perfectly convinced that Smithfield-market and the churchyards will continue the same profitable speculations that they are now; that the great water companies will continue to furnish their unlucky customers with the same delectable article which they have hitherto supplied; and that, under the able management of Mr. Chadwick, the sinks, cesspools, drains, and sewers of the metropolis will in the course of time become still somewhat more offensive than they are at present.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Alexander Swan, of Kirkealdy, in the county of Fife, manufacturer, for improvements in heating apparatus, and in applying hot and warm air to manufacturing and other purposes where the same are required. Patent dated March 14th, 1849. Enrolled September 14th, 1849.

This specification relates to the arrangement and construction of steam-boilers and other heating apparatus, and the mode of setting flues for the passage of the heated air and products of combustion, which, instead of passing in a longitudinal direction from end to end of the boiler, and thence to the chimney in the ordinary manner, traverse around (in a spiral direction) a longitudinal tube, which constitutes a part of the boiler or heating apparatus.

The first part of the specification relates to steam-boilers. Below the ordinary boiler is placed a longitudinal tube or cylinder, which communicates by short pipes with the boiler, and is, therefore, constantly full of water. The heated air and products of combustion traverse along flues in a spiral direction around this tube to the end furthest from the furnace, whence they rise, and traverse in the ordinary manner and direction under the boiler into the chimney. By this mode of arrangement and construction of the flues, the heated air and products of combustion traverse over nearly the whole surface of the longitudinal tube, by which a very considerable quantity of the heat is absorbed previous to their reaching the surface of the boiler. In the drawings accompanying the specification a self-acting damping apparatus is shown; it consists of a cylinder provided with a solid plunger, at the bottom of which is a disc of vulcanized indiarubber, or other suitable flexible material; the pressure of the steam in the boiler acts against the under side of the flexible disc, and against the bottom of the plunger; the top of the plunger is connected by a toothed pinion and rack to a damper near the chimney. Any variation, therefore, in the pressure of the steam in the boiler causes the damper to increase or decrease the area of the flue into the chimney, and thereby to regulate the draught.

The second part of the specification refers to the application of the before-described arrangement of flues to retorts for the distillation of coal, peat, and other similar substances, and which is very nearly identical with that already described with respect to steam-boilers.

The third part describes its adaptation to the purpose of evaporating lees. In this arrangement two cylinders or tubes are employed; they run in a longitudinal direction; the one is placed above the lees, traversing through the lower one, and then, rising into the upper one, traverses that, and finally passes into a vertical vessel, where the steam generated passes off by a pipe, and the remaining lees finds its way again to the lower tube, and again traverses the apparatus until sufficiently evaporated, when it is discharged, and the apparatus charged with a fresh supply.

The fourth part describes the adaptation of this arrangement of fluids to the purpose of heating, drying, and desiccating.

The patentee claims:—

First. The construction of steam-boilers, as described, in so far as regards the combination of straight or rectangular cylinders, or tubes with curves, or spiral tubes, or flues, for the purpose of generating steam.

Secondly. The apparatus described for the distillation of coal, peat, and other similar substances, in so far as regards the combination of straight or rectangular tubes, with curved or spiral tubes, or flues, and its application to the distillation of coal, peat, and other like substances.

Thirdly. The apparatus described for the purpose of evaporating lees, in so far as regards the above-described combination of straight or rectangular cylinders, or tubes, with curved or spiral tubes, or flues; and the mode described of separating the steam from the lees.

Fourthly. The apparatus described, in so far as regards the combination of straight or rectangular cylinders, or tubes, with curved or spiral flues, for heating, drying, or desiccating purposes generally.

Henry Fisher, of Upholland, in the county of Lancaster, gentleman, for improvements in coke ovens, and in machinery and apparatus for working the same, or connected therewith; and a mode or modes of applying certain portions of coke or the residual portions of coke to heating and lighting. Patent dated February 8th, 1849. Enrolled August 8th, 1849.

This specification is somewhat voluminous, and relates to the processes of manufacturing coke, and to the arrangement and construction of coke ovens, &c. The specification is divided into several heads, and the improvements aim principally at the production of a greater quantity of coke, and of superior quality, from a given quantity of coal than has hitherto been obtained. This the patentee effects by a better distribution of the supply of atmospheric air to the ovens, which causes a more perfect combustion of the gases evolved from the coal in the coking process.

The first head of the specification describes the patentee's mode of constructing coke ovens. The improvements consist in providing the ovens with a number of air-passages and apertures, by which the supply of atmospheric air is conveyed to the interior of the oven; these passages and aperture being through the crown of the arch, the atmospheric air is more effectually combined with the gases, and the more perfect combustion in the latter is effected, in consequence of the gases accumulating at the top; there is also a discharge flue or passage upon the wall or pier between two adjacent ovens, which communicates by other flues or passages to both of the ovens and to the main flues. The object of this arrangement is to effect the necessary draught.

The second head describes the patentee's mode of charging ovens, which is effected by an opening through the crown or arch of the oven. The patentee describes two or three modifications of constructing the crown or arches of the oven, so as to enable the oven to be charged from the top.

The third head of the specification is the description of an apparatus, the object of which is, to spread the coal charged into the oven from the top evenly and regularly over the bottom of the oven. This apparatus consists of two iron plates or frames attached loosely to a shaft or rod. The plates are allowed to expand or recede from each other at one end to the extent allowed by chains attached to them. A chain attached to the shaft enables the apparatus to be lowered into the oven through the charging opening, and other chains attached to the frames cause it to assume a sort of A roof from under the opening; by this arrangement the coals are evenly distributed over the bottom of the oven.

The improvements described under the fourth head consist in the construction of apparatus for the purpose of discharging the manufactured coke from the ovens. This discharging apparatus consists of a draw-plate applied through the back opening or door of the oven, and having attached to it a rod, passing from the front opening or door through a tube laid upon the bottom of the oven, previous to charging. If requisite, the draw-plate may be made hollow, and cold water passed into it to keep it cool. The patentee likewise describes several modes of working the discharging apparatus either from the front, back, or top of the oven.

The fifth part of the specification consists of a mode of constructing the several parts of the discharging apparatus, so as to enable them the better to withstand the great heat of the oven, and, consequently, to last a greater length of time. In place of making these parts of solid metal rods or bars, the patentee makes them hollow, and fills them with sand, pounded brick, or other substances of imperfectly conducting power, by which means they bear the heat better, and last much longer than usual.

The sixth part describes an improved mode of opening and closing the doors of the oven; and

The seventh part consists of a mode of cooling down the manufactured coke after the process of coking is complete. To this end the patentee closes up—when the coking process is complete—all the apertures into the oven; and through a supply-pipe, provided with a stop-cock, a quantity of steam from a boiler is admitted, which has the effect of speedily cooling down the temperature of the coke without injury to the oven, and with advantage to the quality of the coke. The patentee proposes also to employ for the same purpose, in lieu of steam, carbonic

acid, admitting it to the oven in same manner, through a supply-pipe. The introduction of either of these articles expels the atmospheric air, and thereby prevents further combustion from taking place.

Andrew Shanks, of Robert-street, Adelphi, Middlesex, engineer, for an improved mode of giving form to certain metals when in a fluid or molten state. Patent dated March 14th, 1849. Enrolled September 14th, 1849.

The improved mode which forms the subject matter of this patent consists in casting pipes, cylinders, and spherical vessels without using cores during the process of casting. For this purpose a metal mould of the pipe or cylinder is put upon a machine consisting of several drums or pulleys, upon which the mould rests. When the molten metal is to be poured into the mould the drums are set in motion by some moving power, which causes the mould to revolve steadily upon its axis; the molten metal is thus made to adhere by centrifugal force to the sides of the mould, which is kept in a state of motion till the metal becomes cold or set. When the hollow vessel is of a spherical form the mould is set upon the top of an upright spindle, which is kept revolving while the metal is being poured in, and until it sets as in the former case.

Claim.—The mode of forming pipes and cylinders by means of centrifugal force and without the aid of cores.

Thomas Clarke, of Hackney, Middlesex, engineer, and Thomas Motley, of Bristol, civil engineer, for certain improvements in obtaining and applying motive power, also improvements in railroads and other roads, and in supporting pressure, resisting strain, and protecting against fire. Patent dated March 14th, 1849. Enrolled September 14th, 1849.

The patentees describe:—

1. A tubular boiler in which the tubes are of a much smaller bore than usual, and a fan is employed to cause the water to circulate through the tubes.

Claim.—The application of a fan to cause the circulation of the water and the separation of the steam.

2. A carriage and locomotive combined—the novelty of which appears to consist solely in the combination.

Claim.—The locomotive and carriage, as described.

3. A pile-driving engine of peculiar construction. A rope or chain is attached to the head of the pile—then passed over a pulley, fixed to the top of a piston rod of a steam, water, or air cylinder—after which it is carried up over a pulley affixed to the upright shears of the frame, and attached to the ram. By this arrangement the lift of the ram from the pile at each stroke of the engine continues uniform. The same kind of motion and machinery may, it is stated, be employed for boring holes in stone, by substituting the boring tool for the ram.

Claim.—The arrangements of the pile-driving engine, as described.

4. An improved steam excavating machine, in which the motion of the shovelling and lifting tool is produced by a crank and levers, so that it describes nearly an elliptical path.

Claim.—The excavating machine, with the "circular motion" given to the excavator.

And, 5. Several other improvements relating to the construction of roofs, beams, girders, and bridges, to the formation of carriage-ways by lines of wooden blocks, and to the rendering of floorings fireproof.

Francis Hay Thomson, doctor of medicine, of Hope-street, Glasgow, for an improvement or improvements in smelting copper and other ores. Patent dated March 14th, 1849. Enrolled September 14th, 1849.

The patentee has disclaimed the words "and other," and confined his patent to the smelting of copper ores alone. The improvement therein consists in the application of whinstone iron slag, or other similar matters consisting chiefly of silex, as a flux to be employed in the reduction of the ores, whether in the form of sulphurets, carbonates, or oxides. A good flux is stated to be obtained by using with one ton of the calcined copper ore four hundred weight of broken whinstone and seventy pounds of pounded coke; if barilla be added, a smaller quantity of the whinstone will suffice.

Claim.—The employment of whinstone or iron slag, as a flux for copper ores.

George Ferguson Wilson, of Belmont, Vauxhall, gentleman, for improvements in the manufacture of candles and night-lights. Patent dated March 14th, 1849. Enrolled September 14th, 1849.

These improvements relate to the purification of vegetable tallow and paraffine, and to their employment in the manufacture of candles with double wicks.

The vegetable tallow or paraffine is first put into a vessel with about eight per cent. of sulphuric acid, 1.8 sp. gr.; it is afterwards distilled; but, in order that it may be kept from coming in contact with the atmospheric air, the distillation is effected by the introduction of steam in numerous jets at the bottom of the vessel.

No claims.

Pierre A. Fontainemoreau, of South-street, Finsbury, London, for certain improvements in coating or covering metallic and non-metallic bodies. (Communication.) Patent dated March 14th, 1849. Enrolled September 14th, 1849.

The patentee specifies a great number of new solutions of metals which may be employed in coating other metals by the aid of the galvanic battery. We select some of the more remarkable:—

For Gilding.—Take 1 part of chloride of gold, and precipitate with a soap made of gayac pitch; then dissolve the precipitate in 100 parts of hot water, into which there have been put 10 parts of caustic potash, or its equivalent of caustic soda.

Another for Gilding.—Take 1 part of oxide or chloride of gold; dissolve in 200 parts of hot water with 20 parts of caustic potash, or its equivalent of caustic soda, to which add 15 parts of sulphate of potash or soda, for the purpose of rendering the fluid more capable of conducting the galvanic current.

For Platinizing.—Use a solution of bichromate of platinum and potassium.

For Silvering.—Use a solution of the carbonate of silver and the carbonate of ammonia.

Allen Bragg, of Queen's-row, Pentonville, bath-keeper, for improvements in propelling by atmospheric pressure. Patent dated March 14th, 1849. Enrolled September 14th, 1849.

The object of these improvements is the same which has occupied the attention of so many inventors, viz., to get rid of the slit in the atmospheric main. The arrangements adopted for this purpose by the patentee consist in having sets of cylinders laid between the rails, and parallel thereto, each cylinder being fitted with a piston, the rod of which passes through stuffing-boxes in the ends of the cylinder, and is connected outside to a longitudinal bar, notched or toothed upon its upper edge. The cylinders placed between the rails are connected by short pipes to the main exhaust-pipe, which is laid outside of the rails. The propelling carriage, in coming over the positions of the respective cylinders, becomes partially connected to the notched bars by means of a paul which falls into one or other of the notches; and the movement of the piston is effected at the same instant (by the communication being opened up between the cylinder and the air exhaust-pipe), which causes the carriage to be propelled so much in advance, by which it comes in contact with the notched bar connected with the next cylinder, where it receives another push forward, and so on continuously, until the pauls are lifted up from coming in contact with the notched bar.

Claim.—The above mode of propelling by atmospheric pressure, and especially the notched bar attached to the piston rods.

James Williamson Brooke, of Camden-town, gentleman, for improvements in lamps. Patent dated March 14th, 1849. Enrolled September 14th, 1849.

These improvements have special reference to spirit-lamps. The spirit is contained in a glass reservoir, from which it is conveyed, by capillary attraction, through a cotton wick into an upright metal tube, where it is vaporized by the heat of the burner, and from which the gas or vapour generated is conveyed through two small holes into another tube, where it gets mixed with atmospheric air admitted by a hole in the side of that tube (the top of which forms the burner). The mixed gases, or air and vapour, escape through holes pierced in the burner where it is ignited.

Two other varieties of burners are shown in the drawing as being applicable to the same sort of lamps. In one of these the slit across the burner is at the top, so that the flame is of a flat form; in the other a flat flame is produced by the gas being allowed to escape from a hole directed at an angle to a plane surface or plate of metal.

Claims.—1. The lamp, as described.

2. The two varieties of burners, as described.

Thomas Henry Russell, of Wednesbury, patent tube-manufacturer, and John Stephen Woolrich, of Birmingham, chemist, for improvements in coating iron and certain other metals and alloys of metals. Patent dated March 19th, 1849. Enrolled September 19th, 1849.

These improvements consist, firstly, in coating iron by the metal cadmium, either with the aid of electricity, galvanism, or the magneto-electric machine, or by immersion in a hot bath of the metal.

When the coating is to be effected by means of the galvanic trough, a precipitate of cadmium is first formed, which is then dissolved in a solution of the cyanate of potassa. The articles to be coated are immersed in the solution and treated in the usual manner now practised in coating metals by the aid of the galvanic battery. The positive wire should terminate in a plate of cadmium, and that should surround or be placed at a few inches from the surfaces to be coated.

When the articles are to be coated by immersion in the molten metal, then a portion of tin is to be added to the cadmium. The articles are cleaned by dipping in dilute acid, and then plunged into the melted metal; being kept in which for some time, the surfaces will become coated. The surface of the melted metal is kept covered with oil or tallow, to prevent the action of the oxygen of the atmosphere upon it.

Articles made of iron may be protected by being partially covered with cadmium, such as screw-propellers, &c.

The patentees describe, secondly, certain methods of coating metals with copper by the aid of the soluble acetates, benzoates, and cyanates of potassa.

Claims.—1. The coating of metals or alloys of metals with cadmium, or alloys of cadmium, and the partially covering of articles to be protected with cadmium.

2. The coating of metals with copper or alloys of copper, by means of the soluble acetates, benzoates, and cyanates of potassa.

William Harrison Pickering, of Liverpool, merchant, for improvements in evaporating brine and certain other fluids. (Communication.) Patent dated March 19th, 1849. Enrolled September 19th, 1849.

The patentee proposes to employ for evaporating brine two large shallow vessels con-

nected together; the one is about twice the depth of the other; the deepest vessel or pan contains coils of steam-pipes laid horizontally, with their upper side above the surface of the fluid to be evaporated, and leaving a space below them, from which the deposited salt may be easily taken. The two vessels, when connected together, are provided with sluices, one near the bottom and the other near the surface of the fluid. The cold brine flows into the steam-heated vessel at the lower sluice, and the heated brine flows out to the other vessel by the upper one.

Claims.—1. The sluices employed in pans for evaporating salts, to allow of a free circulation of the fluid through the pans.

2. The having the one vessel containing the steam-pipes deeper than the other vessel, and connecting them together by an inclined plane.

Alexander M'Dougall, of Longsight, Lancaster, chemist, for improvements in recovering useful products from the water used in washing and in treating wool, woollen cotton, and cotton fabrics and other fabrics. Patent dated March 19th, 1849. Enrolled September 19th, 1849.

The specification of this patent describes those improvements only which relate to recovering "useful products from the water used in washing." These consist in forming a precipitate of the soap in the water by means of the muriate of lime (or chloride of calcium), from which the water is extracted, after which it is treated with muriatic acid in the same way as animal fatty acids are treated by candle-makers. A resulting product of this treatment is the muriate of lime, which can be again employed for the same purpose.

Claim.—The means described for recovering useful products from water employed in washing.

Samuel Hall, of King's Arms-yard, Coleman-street, London, C.E., for improvements in apparatus for effecting the combustion of fuel and consuming smoke, and for preventing explosions of steam-boilers, and other accidents to which they are liable. Patent dated March 19th, 1849. Enrolled September 19th, 1849.

In this new apparatus, or furnace, of Mr. Hall, the bars are inclined from the horizontal line towards the back of the furnace; they are acted upon by revolving eccentrics to which they are attached, so as to have an alternating motion from front to back of the furnace. At front the top of the furnace is covered with a boiler protector (a water-heater); at the further end of the furnace there is a trap-door formed of fire-brick, upon which the scoria from off the bars collects, and which is acted upon by a hand lever, so that the unburnt materials upon it may fall into the ash-pit.

The steam-boiler is provided with a pipe leading from the safety-valve to the furnace, so that in the event of steam blowing off at the valve it is conveyed into the furnace, and damps the fire.

The specification next describes a feeding apparatus for supplying water to the boiler, which consists of a chamber which is alternately filled and emptied into the boiler by means of two cocks, the one leading from a supply pipe into the chamber, the other leading from the chamber into the cistern. The cocks are opened and closed by means of wheel-gear attached to them; the speed of the wheels is regulated by the float, which is made to act upon a band running over two cones, which causes the wheels to turn quicker or slower, according to its position on the cones.

The last improvement described consists in having wheel gearing attached to the safety-valve, which causes it to keep constantly turning round on its seat, and thereby prevents the risk of its becoming locked.

William Parkinson, of Cottage-lane, City-road, Middlesex, gasmeter manufacturer, successor to the late Samuel Crosley, for improvements in gas and water meters, and in instruments for regulating the flow of liquids. Patent dated March 20th, 1849. Enrolled September 20th, 1849.

Mr. Parkinson describes and claims:—

1. An improvement in (wet) gasmeters, which consists in placing the aperture through which the water is supplied to the meter at an elevation above the proper level of the water therein, and the mouth of the overflow-pipe at or about the centre of the area of the water in the meter.

2. An improved adaptation of the drum or wheel of the ordinary gasmeter to the measuring and registering of quantities of water.

3. An improved ballcock, which differs from that of Lambert in this chiefly, that the plug, instead of acting against a flexible diaphragm, takes into a recess made for it in the back part of the cock.

Charles William Siemens, of Birmingham, engineer, for certain improvements in engines to be worked by steam and other fluids, and in evaporating liquids. Patent dated March 20th, 1849. Enrolled September 20th, 1849.

The first of these improvements is in a method of allowing the greater portion of the exhaust steam to escape into the atmosphere by an escape-valve; the remainder is employed to heat the water of condensation for feeding the boiler; the invention being in these respects similar in principle to Urwin's engine, described in the *Mech. Mag.*, Nos. 1,353, 1,354, 1,356.

A second improvement is in a condenser, which formed the subject of a former patent of the patentee.

The chief claims in respect of both improvements have reference to the means employed for reducing the quantity of water required for condensation, and the recovering of the heat carried off by the waste steam.

A third improvement relates to the construction of evaporating-pans; the object aimed at is the recovery and re-employment of the heat of the steam used for producing the evaporation.

Claim.—The evaporating apparatus described.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING SEPTEMBER 13, 1849.

Richard Archibald Brooman, of Fleet-street, patent agent, for certain improvements in draught-horse saddlery, harness, and saddle-trees. Patent dated September 13th, 1849; six months.—(Communication.)

David Stephens Brown, of the Old Kent-road, gentleman, for certain improvements in apparatus or instruments for the fumigation of plants. Patent dated September 13th, 1849; six months.

Henry Attwood, of Goodman's-fields, in the county of Middlesex, engineer, and John Renton, of Bromley, in the same county, engineer, for certain improvements in the manufacture of starch and other like articles of commerce from farinaceous and leguminous substances. Patent dated September 13th, 1849; six months.

Edme. Augustin Chameroy, of Rue du Faubourg St. Martin, in the city of Paris, for a new system of railway (denominated Helicoide's heliacal railway) and a circular chariot. Patent dated September 13th, 1849; six months.

Napoleon Pierre Preterre, of Harve, in France, for improvements in the construction of coffee and tea pots, and in apparatus for cooking, also in apparatus for grinding and roasting coffee. Patent dated September 13th, 1849; six months.

Edwin Heywood, of Glasburn, in the county of York, designer, for improvements in plain and ornamental weaving. Patent dated September 13th, 1849; six months.

Robert Griffiths, of Havre, engineer, for improvements in steam-engines, and in propelling vessels. Patent dated September 13th, 1849; six months.

Thomas Marsden, of Salford, in the county of Lancaster, machine-maker, for improvements in machinery for hackling, combing, or dressing flax, wool, and other fibrous substances. Patent dated September 13th, 1849; six months.

Benjamin Goodfellow, of Hyde, in the county of Chester, engineer, for certain improvements in steam-engines. Patent dated September 13th, 1849; six months.

James Potter, of Manchester, mechanist, for certain improvements in spinning and doubling machinery. Patent dated September 13th, 1849; six months.

Charles Marsden, of Kingsland-road, for improvements in traps to be applied to closets, drains, sewers, and cesspools. Patent dated September 20th, 1849; six months.

William Edward Newton, of Chancery-lane, civil engineer, for certain improvements in pumps, and in machinery and apparatus for working the same, which latter improvements are also applicable for working other machinery. Patent dated September 20th, 1849; six months.—(Communication.)

William Handley, of Chiswell-street, Finsbury, confectioner, George Duncan, of Battersea, engineer, and Alexander M'Glashan, of Long Acre, engineer, for improvements in the construction of railway breaks. Patent dated September 20th, 1849; six months.

Henry Bessemer, of Baxter-house, Old St. Pancras-road, engineer, for improvements in the preparation of fuel, and in apparatus for supplying the same to furnaces. Patent dated September 20th, 1849; six months.

Elijah Galloway, of Southampton-buildings, Chancery-lane, engineer, for improvements in furnaces. Patent dated September 20th, 1849; six months.

Joseph Rocke Cooper, of Birmingham, gun and pistol maker, for improvements in firearms. Patent dated September 20th, 1849; six months.

Edward Staite, of Lombard-street, gentleman, and William Petrie, of King-street, gentleman, for improvements in electric and galvanic instruments and apparatus, and in their application to lighting and to motive purposes. Patent dated September 20th, 1849; six months.

William Pearce, of Haigh, near Wigan, Lancaster, and Edward Evans, of Wigan, engineers, for improvements in steam-engines and in pumps. Patent dated September 20th, 1849; six months.

Josiah Lorkin, of Ivy-lane, merchant, for an improved instrument or apparatus for beating or triturating viscous or gelatinous substances. Patent dated September 20th, 1849; six months.

Benjamin Wren, of Yarm, in the county of York, miller, for an improvement in cleaning and treating certain descriptions of wheat. Patent dated September 20th, 1849; six months.

David Owen Edwards, of Sydney-place, Brompton, surgeon, for improvements in the application of gas for producing and radiating heat. Patent dated September 20th, 1849; six months.

John Baptiste Vauldy, of Mile-end, dyer, for improvements in giving a gloss to dyed silk, in skeins or hanks. Patent dated September 20th, 1849; six months.

Thomas Griffiths, of Islington-row, Birmingham, for improvements in the manufacture of tea and other pots and vessels and other articles made of stamped metal. Patent dated September 20th, 1849; six months.

PATENT RECENTLY EXPIRED.

J. J. Sheridan, Walworth, chemist, for an improvement in the manufacture of soap. Patent dated September 17th, 1835. Expired September 17th, 1849.

CAPTAIN FITZMAURICE'S ROTARY ENGINE.—Captain W. H. Stewart, and Mr. F. P. Smith, of the screw propeller department at the Admiralty, proceeded a few days since to Taplow to satisfy themselves how far the report (See page 202) of the perfection of Captain Fitzmaurice's Orkney rotary engines was correctly stated, and, although the rain poured in torrents during a greater part of the time the experiments were carried on, they admitted the

result to be very satisfactory. Not anticipating any visitors on such a day, the pieces which had been detached since the previous experiment were hastily put together, and the steam got up, and the boat started against the stream with seven persons on board. The rains had increased the depth of the river nearly two feet since the previous trial, and made the navigation less difficult. The boat started in fine style, and, on Mr. Smith timing the revolutions of the screw, he found them to be 192 per minute, and that may be considered the averaged speed on this occasion, with a very little exception, when the screw got entangled in weeds, which were soon removed (when found adhering) by a few back turns of the screw. The distance ran out and back was about twenty-six miles, and once through the lock of a canal, for which species of navigation it appears to be admirably adapted, having shown on a previous occasion its capabilities for towing by drawing a broad-bowed and flat-bottomed barge, thirty feet long by twelve in breadth, at the rate of three miles an hour against the stream. The speed attained by the boat on this occasion was ascertained by Mr. Smith and Captain Houston Stewart to be fully seven knots per hour, or 8.055 statute miles an hour,—a remarkable result, considering that the boat was in no way constructed for speed. The ease with which the engine could be set in motion, and stopped or graduated to any degree of velocity up to its full speed, was a subject of surprise to the visitors; and the rough manner in which it was used to show its instantaneous effect, and difficulty to put it out of working order, could not be credited unless they were witnessed. The absence of vibration in the engine, and the uniform continuous motion, satisfied the visitors that Captain Fitzmaurice had overcome the difficulties which eminent engineers have always considered it difficult to obviate in rotary engines; and they left, on their return to town, much gratified with the result of all they had witnessed, and pleased with the minute details he entered into when showing the model and explaining the principle on which the two pieces of which it consists work the one within the other.

Paper Hangings for Walls.—The invention of covering walls with ornamented paper is claimed by the French, English, and Germans. The most beautiful kinds of paper for walls is the velvet and satin. The printing of paper is about the same as calico printing. Wooden blocks are most commonly used for printing on the patterns, and so much skill is exhibited in its manufacture, that some paper is made to adorn the walls of rooms so as to give them the resemblance of every variety of marble; and sometimes they are studded with precious stones, almost to deceive a connoisseur's eye. Some halls are decorated with paper to represent groves, different kinds of architecture, sea scenes, and scenes of cities, courts, and camps. Velvet or flock paper is printed like the plain kind, but the parts to be covered are made wet with glue, and some kind of woolly substance of the colours desired, reduced to powder, is strewed over it, which, by adhering to the glue, gives the paper the appearance of being partly covered with velvet. The shearings of fine white woollen cloth, dyed various colours, are generally employed for this purpose. The French velvet paper has the greatest character in America; although it is not likely that all which is sold for French paper is made in France. The English claim the invention of velvet paper, and, in fact, they have good grounds for such a claim, as a patent was granted in London in 1732 to one Jerome Lanyard, for the "affixing of wool, silk, and other material of divers colours upon linen, cloth, silk, cotton, leather, and other substances, with oil, size, and other cements to make them useful and serviceable for hanging and other occasions." The French, however, say that this art was known in that country as early as 1620, and the name of the English patentee appears to be a foreign one, perhaps one of the Huguenots. One very beautiful way of ornamenting paper is to give it a metallic appearance, silvering it with pounded sand or glass; and also giving it a metallic appearance of various colours, by using the metallic powders so well known, of every colour, gold, silver, &c. The inventor of metallic dust for ornamenting paper was a German artist at Nuremberg, named John Hautsche. The metallic dust invented by Hautsche is prepared by sifting the filings of different metals, washing them in a strong lye, then placing them on a plate of copper over a strong fire, stirring them continually till their colour is altered. Those of tin, by this process, acquire every shade of gold colour with a metallic lustre, those of copper acquire various orange and red shades, those of steel become blue or violet, and those of bismuth and tin mixed of a whitish colour. The dust tinged in this way is afterwards passed between two hardened steel rollers, the same as those used for silver and gold wire drawing. Instead of metallic dust for silvering paper, fine silver—white mica—is far better, and is generally used. The patterns on paper are frequently printed in size, and gilt leaf applied afterwards, or bisulphuret of tin is dusted over, so as to adhere to the pattern, and the velvet powder of flocks is applied in the same way. French chalk is the substance used to produce the peculiar gloss on paper named satin. Various kinds of paper are now printed by machines, although it is not long since that all was done by hand-block printing. Paper printing is now an important branch of American manufacture and trade, as there is no other people in the world who so universally employ paper for ornamenting the walls of their houses. A higher domestic taste is displayed among us than among any other people. There are but few families of the working people of Europe who know the luxury of a papered ornamental parlour. We believe that domestic taste and comfort is a good test of a nation's civilization: we know of no other to equal it.—*Scientific American.*

Mining in New Zealand.—By way of Sydney we have received a file of New Zealand papers, from which we learn that the Kawau Mining Company are erecting extensive smelting-works at Kawau. The *Southern Cross* says:—"We have good grounds for supposing that the Kawau mine will turn out a second Burra, for, though the ore may not be quite so rich, yet it will be obtained at a very much less expense than that from the great South Australian mine. The inland carriage will be saved, which of itself would form an excellent profit. From inquiries which we have lately been making, we find that operations are so forwarded at the Kawau that the digging out of the ore will now proceed with great rapidity after the calcining and smelting works are completed." Four shafts have been sunk and several levels driven, and the latter are said to have laid open an enormous quantity of ore, estimated at 100,000 tons, and now capable of being produced "at grass" at 1s. 6d. per ton. The prices paid for sinking the shafts are stated to have varied from £40 to £80 per fathom, and £10 to £16 for driving the levels. There were about 1,000 tons of ore on the surface ready for smelting. It is estimated that the calcining-house will calcine about 144 tons per week. There are only about six miners on the works, but, as those six could raise, it is estimated, 60 tons per day, they will be able to do much more than keep the calcining and smelting works in full operation.—*Adelaide Observer*, April 18.

Supply of Water to London.—It will be remembered that at the end of last year a plan was propounded for bringing water to London from the River Thames at Henley, promising to ensure to every inhabitant of the metropolis an unremitting supply of this all-important desideratum within his own house. The opposition was manifold, and the bill was lost on the second reading. The promoters of that bill have, it seems, resolved on a fresh attempt, modifying their scheme so as to get rid of some of their opponents, and they propose to place the management of the undertaking in the hands of a representative commission. Water is to be brought from Henley by means of an aqueduct (not a canal, as at first intended), and to be delivered into a reservoir at Hampstead, high enough to supply the loftiest buildings, and extinguish fires without engines. We are not at this moment in a position to assert that their plan for supplying London with pure water is the best suggested, but we do say that the importance of the object is such, the necessity for water is so great and paramount, that the proposal ought to receive the most candid and careful consideration. When it is known that at the present moment there are 70,000 houses in London, containing not less than 560,000 inhabitants, which have no water supplied to them from any one of the eight great water companies which exist, further argument must be unnecessary. All London ought to cry as loudly as if next door were on fire—"Water! water!! water!!!"—*Builder.*

Method of Cleaning Vessels and other Articles of Silver.—Boil thirty grms. of finely pulverized and calcined hartshorn in a quart of water, and while on the fire put as many silver articles in the vessel used for boiling as it will hold, and leave them there for a short time; then withdraw them, and dry them over the fire. Continue this until all the articles have been treated in the same manner. Then introduce into the hartshorn-water clean woollen rags, and allow them to remain until saturated; after which dry them, and use them for polishing the silver. This is also the best substance which can be employed for cleaning locks and brass handles of room doors. When the silver articles are perfectly dry, they must be carefully rubbed with a soft leather. This mode of cleaning is excellent, and much preferable to the employment of any powder containing mercury, as mercury has the effect of rendering the silver so brittle as to break on falling.—*Technologiste;* and *Newton's Journal.*

TO CORRESPONDENTS.

"Mr. A. Scholefield, Basingstoke, Hants."—You will find an explanation of the phenomenon alluded to in your letter in Turner's "Chemistry" (last edition by Liebig and Gregory), in the chapters on "Electricity" and "Iron." The decomposition of the oxide of iron by the hydrogen is effected in the same manner in which the decomposition of potassa is effected by iron, although the affinity of this metal for oxygen seems much inferior to that which potassium evinces for the latter element. You seem to entertain a notion that the reduced iron combines with the hydrogen; this is not the case: the hydrogen combines with the liberated oxygen, and the iron is left in the metallic state in the form of a porous spongy mass.

"H. C."—Received.

"Mr. Milman, Bristol."—Out of print.

"Mr. James Bevan, Belfield Printworks, near Rochdale. The works which you mention in your letter contain all the information on this subject with which we could possibly supply you. However, we will consult the works of some of the continental chemists; and if we find anything new in them we will communicate it to you.

"R. T. S."—The patent expired more than six months ago.

"Mr. Manby, Birmingham."—It is not in our power to give you the desired information.

"W. T."—The price of Ure's "Dictionary" (with Supplement) is £3 4s.

"A Subscriber."—The "boules de Nancy" consist simply of equal parts of iron filings and red tartar, made up into balls with spirit.

"Nemo."—The subject is not within our province.

London: Printed by Robert Palmer, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London, and published by the said Robert Palmer, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—September 29, 1849.

ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXXVI.

(LECTURE CIX.)

VEGETO-ALKALIS—(*Continued*).

ACONITINA—ANEMONIA.

Aconitina was discovered by Brandes in the wolf's-bane (Aconitum napellus — Ranunculaceæ). It has been studied since by Geiger, Hesse, and Berthemot. It is a fixed organic base. It crystallizes in white grains; it presents itself frequently as a colourless, transparent mass; it has no smell; its taste is bitter, but free from acridity. It is sparingly soluble in water, but dissolves readily in ether, and more readily still in alcohol. It forms in crystallizable salts.

Aconitina is one of the strongest vegetable poisons.

Berthemot gives the following process for extracting it from the dry leaves of the wolf's-bane:—

Prepare an alcoholic extract of the dry leaves, redissolve this extract in water, filter the solution, and evaporate the filtrate to a syrupy consistence; redissolve the syrupy extract in alcohol of 40° Cartier, filter the solution through animal charcoal, and then distil off the alcohol. Dissolve the residue in water, acidulate the solution slightly with sulphuric acid, filter, and concentrate the filtrate to a syrupy consistence. Add lime-water to the residuary mass, whereupon a yellow precipitate will subside: this precipitate contains the aconitina. Remove now the supernatant liquid. Dry the yellow precipitate, and, when dry, treat it with boiling alcohol. Filter the alcoholic solution obtained, and distil off the alcohol. Dissolve the resinous residue in dilute sulphuric acid, and filter the solution through animal charcoal. Precipitate the aconitina from the yellowish filtrate by means of ammonia; the precipitate becomes instantly hydrated, and presents a white aspect; but soon after, when collected on the filter, for the purpose of drying it, it loses its hydration water, and assumes a brown tint; at the same time it becomes brittle, and may be readily reduced to powder. The powder thus obtained is white, with a slight shade of yellow.

Our knowledge of aconitina is still very imperfect. The aconitina of Berthemot differs from that of Geiger in some most important points; for instance, Geiger's aconitina dilates the pupil, whereas Berthemot's (like the preparation of wolf's-bane) contracts it strongly. The former, moreover, does not possess the strong and persistent acridity of the aconites.

Dr. Turnbull has exhibited Berthemot's aconitina in nervous affections, tic douloureux, diseases of the eye and ear, toothache, &c. He gives it almost invariably alternately with veratria and delphia.

Rubbed on the skin, it produces heat, and a sensation of shuddering.

ACONITINA LINIMENT.

Take of Aconitina, 1 gramme.
Olive oil, 2 grammes.
Hogslard, 32 grammes.

Mix.

To be used in frictions, two or three times a day, in nervous affections, recent cataract, and certain diseases of the ear.—(Dr. Turnbull.)

ACONITINA EMBROCATION.

Take of Aconitina, 1 gramme.
Rectified alcohol, 125 grammes.

Dissolve.

TURNBULL'S ACONITINA DROPS.

Take of Aconitina, 25 centigrammes.
Rectified alcohol, 32 grammes.

Dr. Turnbull introduces these drops into the cavity of the ear in certain diseases of that organ.

ACONITINA PILLS.

Take of Aconitina, 5 centigrammes.
Liquorice powder, 1 gramme.
Syrup, a sufficiency.

Make 14 pills.

Dose, one pill every three hours.—(Turnbull.)

WOLF'S-BANE.

The chemical composition of wolf's-bane (Aconitum napellus) remains as yet but imperfectly known to us. As early as 1808 Steinacher attributed the energetic medicinal properties of the wolf's-bane to the presence and action of a volatile principle. Braconnot, in his investigation on the Ranunculaceæ, found that the wolf's-bane contains an acrid matter analogous to that of the other plants of the same family. Vauquelin obtained the same results. Bucholz, in the course of his investigation on wolf's-bane, felt serious inconvenience from the emanations of this principle.

The presence of a volatile acrid principle in wolf's-bane is accordingly sufficiently established, but the properties of this principle are as yet almost altogether unknown to us.

Besides this acrid volatile principle and aconitina, wolf's-bane contains:—

An extractive matter,
Albumen,
Green wax,
Gum,
Acetic acid,
Malic acid,
Several salts.

Among the latter we may mention more particularly the aconitate or pyrocitrate of lime. This salt is very sparingly soluble; some of the aconites contain an abundance of it.

Wolf's-bane is a dangerous plant which should be used with great caution. It enjoys some reputation as a remedial agent in nervous and rheumatic affections.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON THE INORGANIC CONSTITUENTS OF ORGANIC BODIES.

By H. ROSE,

Professor of Chemistry in the University of Berlin.

[*Continued from page* 177.]

APPENDICES TO PROFESSOR ROSE'S PAPER.

APPENDIX IX.

EXAMINATION OF THE INORGANIC CONSTITUENTS OF THE FLESH OF THE HORSE. BY M. WEBER.

The flesh consisted of the muscles of the fore leg of a lean horse, immediately after the animal was killed, and completely freed from blood by the injection of water into the brachial artery until it escaped from the veins in a colourless state; it was then dried and carbonized.

The residue of the aqueous extract was perfectly free from carbonic acid, and consisted of—

Chloride of sodium	3.43	Na Cl	3.43
Potash	48.19	$2KO+PO_5$	83.27
Soda	5.18	$2NaO+PO_5$	11.10
Phosphoric acid	41.68	KO, SO_3	1.52
Sulphuric acid	0.71		
	99.19		99.32

The muriatic extract consisted of—

Potash	26.47
Soda	4.36
Lime	6,02
Magnesia	12.20
Peroxide of iron	3.96
Phosphoric acid	46.99
	100.00

Assuming that the phosphoric acid forms pyrophosphates with the bases, we obtain the following calculated result:—

Bibasic phosphate of lime	13.64
Bibasic phosphate of magnesia	33.27
$2FeO_2+PO_5$	1.22
Bibasic phosphate of potash	30.14
Potash	9.28
Soda	4.45
	100.00

If, however, we admit that both the alkalis and the earths, excluding the magnesia, form *e*-phosphates, we obtain the following result:—

Tribasic phosphate of potash	39.82
Tribasic phosphate of soda	7.66
Tribasic phosphate of lime	11.35
Bibasic phosphate of magnesia	33.27
Perphosphate of iron	7.50
	99.60

The amount of phosphoric acid required by calculation is 46.61 per cent.; that found by analysis amounts to 46.99 per cent.

Residuary Carbonized Mass.—The ash of this consisted of:—

Potash	36.64
Soda	4.71
Lime	1.88
Magnesia	4.36
Peroxide of iron	0.76
Phosphoric acid	51.65
	100.00

The precipitate thrown down by ammonia from the muriatic solution of this ash, after having been heated to redness, consisted of $2CaO, PO_5 + 2MgO, PO_5 + Fe_2O_3$. The phosphoric acid required by this formula amounts to 9.87 per cent.; analysis gave exactly this quantity. The remaining 41.79 per cent. of phosphoric acid were neither wholly combined with the alkalis as pyrophosphates, nor as metaphosphates. The phosphoric acid is too large in quantity for the former case, and too small for the latter.

The relative amounts of ash in the flesh were as follows:—

Extracted by water	42.81
Extracted by muriatic acid	17.48
Ash of the remaining carbonaceous mass	39.71
	100.00

The amount of the whole of the inorganic constituents of the flesh was:—

		Oxygen.	
Chloride of sodium	1.47		
Potash	39.95	6.77	10.31
Soda	4.86	1.24	
Lime	1.80	0.50	
Magnesia	3.88	1.50	
Peroxide of iron	1.00	0.30	
Phosphoric acid	46.74	26.19	26.36
Sulphuric acid	0.30	1.17	
		100.00	

The proportion of oxygen in the bases to that of the phosphoric acid was as 2 : 5, *i.e.*, the salts were pyrophosphates; and in this respect this ash has some analogy with that of wheat, which, however, contains far more alkaline chlorides.

Thus water and muriatic acid principally extract alkaline phosphates from carbonized flesh, and alkaline chlorides and carbonates from carbonized blood. The muriatic extract of the blood contains altogether so few constituents that we may suppose they are only those which had previously resisted the solvent action of water, or were formed from the anoxidic portion of the blood by the imperfect exclusion of the air during its carbonization.

If so, and we admit that the alkaline chlorides and carbonates do not belong to those constituents of the blood, the inorganic portions of which consist of phosphates in an oxidized and unoxidized state, these constituents of the blood would contain the phosphates in a perfectly deoxidized state. Such are probably the proteine substances of the blood, which would then differ

from those of the flesh, by the former being anoxidic and the latter meroxidic substances. Probably in future we must only call those substances anoxidic, meroxidic, and teleoxidic, the inorganic constituents of which consist principally of phosphates in a deoxidized, partly oxidized, and perfectly oxidized state. The blood will then be an anoxidic, and the flesh a meroxidic, substance.

Aphendix X. and XI.

ANALYSIS OF THE ASHES OF HUMAN FÆCES AND URINE. BY M. FLEITMANN.

Although a single analysis of the ash of the fæces, without regard to the diet, can be of but little physiological importance, inasmuch as it must depend greatly upon the nature of the food consumed and upon the mode of life of the individual, yet a comparative examination of the inorganic constituents of the fæces and urine may afford us instructive conclusions regarding the quantities excreted in the same period of time. Such a comparison had not previously, I believe, been made, and, as we shall see, has yielded a remarkable result. For this purpose the fæces and urine of a young man, aged twenty, were carefully collected during four days. During this period his diet was very moderate.

Fæces.—When dried at 212° F. they weighed only 104.10 grms. They were carbonized as usual.

Aqueous Extract.—On evaporation to dryness it left a residue of 1.933 grm., consisting of:—

Chloride of sodium	3.15
Chloride of potassium	0.37
Potash	27.81
Hydrate of potash	54.18
Phosphoric acid	6.75
Sulphuric acid	1.57
Silica	5.65
Carbonic acid	5.65
	100.00

The large amount of hydrate of potash was produced by the action of the carbon upon the alkaline carbonate. These constituents correspond to the following salts:—

Chloride of sodium	3.15
Chloride of potassium	0.37
Tribasic phosphate of potash	20.13
Sulphate of potash	3.41
Silicate of potash	1.05
Carbonate of potash	17.71
Hydrate of potash	54.18
	100.00

Muriatic Extract.—This left 6.493 grms. of residue, consisting of:—

Potash	10.22	$3CaO+PO_5$	56.98
Soda	1.06	$3KO+PO_5$	15.38
Lime	31.32	$3NaO+PO_5$	1.87
Magnesia	13.98	$3MgO+PO_5$	18.30
Phosphoric acid.	41.69	CaO, SO_3	0.31
Sulphuric acid.	0.18	CaO, SiO_3	0.36
Silica	0.23	MgO	5.48
Peroxide of iron.	1.32	Fe_2O_3	1.32
	100.00		100.00

The magnesia must have existed in the carbonized mass in the form of carbonate.

Residuary Carbonaccous Mass.—This was considerable, and consisted principally of sand, part of which existed as such in the fæces, and even in the food. Part must have been swallowed in the form of dust during the exercise taken by the subject of the experiment in the fields near Berlin. The residue weighed 1.996 grm., and consisted of:—

Potash	4.83	$3KO+PO_5$	7.25
Soda	0.42	$3NaO+PO_5$	0.77
Lime	9.66	$3CaO+PO_5$	12.78
Magnesia	10.24	$3MgO+PO_5$	20.66
Peroxide of iron	6.61	CaO, SO_3	6.45
Phosphoric acid	19.61	MgO	0.62
Sulphuric acid.	3.77	Fe_2O_3	6.61
Silica	6.25	SiO_3	6.25
Sand	38.61	Sand	38.61
	100.00		100.00

Hence the phosphates of the excrements are *c*-phosphates, and the bases are all in the proportion of three atoms to one of phosphoric acid. In the aqueous extract the greater part of the potash is either combined with carbonic acid, or exists in the form of potash; whilst in the excrements themselves the alkali was combined with an organic substance, which occupied the place of an acid. Since the fæces principally carry off those oxidized salts which are insoluble in water, whilst the urine removes those which are soluble in water, most of the inorganic constituents of the fæces are contained in the muriatic extract of the carbonized mass. The large quantity of phosphate of magnesia in this ash is remarkable.

The excrements might be regarded as teleoxidic substances; at least, the unoxidized inorganic matters existing in them are so small that they probably arise merely from the undigested remains of the food. The small quantity of soda present, compared with that of the potash, is also remarkable; especially as the bile principally contains soda, and but little potash. Hence the soda of the bile must be removed by the urine, not the fæces. The following are the inorganic constituents of the fæces as obtained by the three operations:—

Chloride of potassium	0.07	KCl	0.07
Chloride of sodium	0.58	Na Cl	0.58
Potash	12.44	$3KO+PO_5$	14.70
Hydrate of potash	10.05	$3NaO+PO_5$	1.32
Soda	0.75	$3CaO+PO_5$	37.95
Lime	21.36	$3MgO+PO_5$	15.36
Magnesia	10.67	KO, SO_3	0.63
Peroxide of iron	2.09	KO, SiO_3	0.20
Phosphoric acid	30.98	CaO, SO_3	1.43
Sulphuric acid.	1.13	CaO, SiO_3	0.23
Silica	1.44	KO, CO_2	3.28
Carbonic acid	1.05	KO, HO	10.05
Sand	7.39	Fe_2O_3, SiO_3?	3.28
	100.00	MgO	3.53
		Sand	7.39
			100.00

Examination of the Urine.—As the residue of the evaporated urine was very difficult to dry at 212° F., it was carbonized at once.

Aqueous Extract.—This contained by far the greater part of the inorganic constituents of the urine. In the urine excreted during four days it amounted to no less than 54.148 grms. These consisted of:—

Chloride of sodium	62.78	Na Cl	62.78
Chloride of potassium.	9.89	K Cl	9.89
Potash	15.40	KO, SO_3	5.87
Magnesia	0.32	$2KO+PO_5$	16.12
Phosphoric acid	8.92	$3KO+PO_5$	4.55
Sulphuric acid	2.69	$2MgO+PO_5$	0.42
	100.00	$3MgO+PO_5$	0.37
			100.00

Muriatic Extract.—It amounted to 5.085 grms., and consisted of:—

Soda	19.22	$3NaO+PO_5$	33.83
Potash	2.96	$3KO+PO_5$	4.45
Lime	17.66	$3CaO+PO_5$	29.99
Magnesia	13.65	$3NgO+PO_5$	21.98
Phosphoric acid	41.51	CaO, SO_3	3.18
Sulphuric acid	1.86	MgO, SiO_3	6.19
Silica	2.76	Fe_2O_3	0.38
Peroxide of iron	0.38		100.00
	100.00		

Residuary Carbonaccous Mass.—This left a very small quantity of ash on incineration, only 0.352 grm., the principal component of which was silica, weighing only 0.156 grm.; the remainder consisted almost entirely of phosphate of magnesia. It has been suggested above that this small quantity of inorganic constituents existed in the urine in a perfectly oxidized state, and had resisted the solvent action of the muriatic acid, probably because the magnesia had formed with the silica a compound insoluble in dilute muriatic acid.

If this view be adopted, all the inorganic constituents exist in the urine in a perfectly oxidized state; hence it is a perfectly teleoxidic substance.

The following are, therefore, the inorganic constituents of the carbonized mass of the evaporated urine:—

Chloride of sodium	57.03
Chloride of potassium	8.99
Tribasic phosphate of soda	2.90
Tribasic phosphate of potash	4.53
Bibasic phosphate of potash	4.65
Tribasic phosphate of lime	2.57
Tribasic phosphate of magnesia	2.57
Bibasic phosphate of magnesia	0.37
Sulphate of potash	5.33
Sulphate of lime	0.27
Magnesia, peroxide of iron, and silica	0.79
	100.00

These inorganic constituents must not be compared with those existing in the urine before carbonization. In the latter the bases are partly combined with organic acids, which are converted into carbonates during the process of carbonization, the carbonic acid of which is expelled by the phosphoric acid of the bibasic phosphates. Thus tribasic phosphates are formed, which cannot exist as such in the urine, because the latter exerts an acid reaction.

During the four days in which the fæces and urine were collected, the inorganic constituents of the former amounted to 10.422 grms., and the latter to 59.585. This remarkable result would not have been expected *à priori*. The difference becomes still more striking when the amount of the sand is deducted from the inorganic constituents of the fæces, and which can only be regarded as an accidental mixture.

The following comparison exhibits the inorganic components of the fæces and urine excreted in a day, excluding the sand:—

	Urine.	Fæces.
Chloride of sodium	8.9243 grms.	0.0167 grms.
Chloride of potassium	0.7511 "	— "
Soda	.. "	0.0185 "
Potash	2.4823 "	0.5455 "
Lime	0.2245 "	0.5566 "
Magnesia	0.2415 "	0.2781 "
Peroxide of iron	0.0048 "	0.0544 "
Phosphoric acid	1.7598 "	0.8072 "
Sulphuric acid	0.3864 "	0.0293 "
Silica	0.0691 "	0.0375 "
	14.8438	2.3438

Hence the amount of inorganic constituents in the urine is more than six and one third times greater than that in the solid excrements.

The following are the weights of the inorganic constituents obtained in the different parts of the examination of the fæces and the urine:—

	Fæces.	Urine.
Extracted by water	18.55	90.87
Extracted by muriatic acid	62.30	8.54
In the ash of the residuary carbonized mass	19.15	0.59
	100.00	100.00

Appendix XII.

EXAMINATION OF THE INORGANIC CONSTITUENTS OF THE BILE (OF THE OX). BY M. WEIDENBUSCH.

Aqueous Extract of the Carbonized Mass—This, when evaporated to dryness, consisted of:—

Chloride of sodium	28.77	Na Cl	28.77
Potash	4.51	$3NaO+PO_5$	14.51
Soda	35.79	$3KO+PO_5$	6.78
Phosphoric acid	8.55	NaO, SO_3	8.55
Sulphuric acid.	4.81	NaO, CO_2	28.27
Carbonic acid.	11.70	NaO, HO	9.34
Silica	0.26	SiO_3	0.26
	94.39		96.48

Muriatic Extract.—This consisted of:—

Potash	3.70		
Soda	11.50		
Lime	27.00		
Magnesia	7.41		
Peroxide of iron	4.21		
Manganoso-manganic oxide	2.11		
Phosphoric acid	41.63		
Silica	2.41		
	99.97	or of	

$3KO+PO_5$	5.56
$3NaO+PO_5$	20.25
$3CaO+PO_5$	49.81
$3MgO+PO_5$	14.71
MgO	0.69
F_2O_3	4.20
MnO, Mn_2O_3	2.11
SiO_3	2.41
	100.00

Residuary Carbonaceous Mass.—The ash consisted of:—

Potash	6.71
Soda	40.49
Lime	2.45
Magnesia	4.01
Peroxide of iron	0.80
Phosphoric acid	3.89
Sulphuric acid	41.63
	99.98

The sulphur may be considered as existing in the carbonized bile, after exhaustion by the solvents, as a constituent of certain compound radicals, in the same manner as was assumed to be the case with the phosphorus in the carbonized product of other organic substances. But in this carbonized mass the amount of sulphur is much larger than would be found by calculation from that of the sulphuric acid obtained. A very large portion of it is volatilized during the oxidation. If the exhausted carbonized mass be mixed with nitrate of baryta, and the mixture be heated to redness, so much sulphate of baryta is obtained that the quantity of sulphuric acid existing in it amounts to 30 per cent. more than that obtained by the mere oxidation of the carbonized mass.

The following are the proportions of the inorganic components of the bile as obtained in the three operations:—

Extracted by water	90.85
Extracted by muriatic acid	4.93
In the ash of the residue of the carbonaceous mass	4.22
	100.00

The following are the whole of the inorganic constituents of the bile of the ox:—

		Oxygen.	
Chloride of potassium	27.70		
Potash	4.80	0.81	10.90
Soda	36.73	9.39	
Lime	1.43	0.40	
Magnesia	0.53	0.20	
Peroxide of iron	0.23	0.07	
Manganoso-manganic oxide	0.12	0.03	
Phosphoric acid	10.45	5.85	17.99
Sulphuric acid	6.39	3.82	
Carbonic acid	11.26	8.14	
Silica	0.36	0.18	
	100.00		

The quantities of the acids are not correct, because, as we have stated, a far larger amount of sulphuric acid would have been obtained had the whole of the sulphur been converted into sulphuric acid.

ON METHYLAMINE AND ETHYLAMINE.

By M. ADOLPHE WURTZ.

M. Adolphe Wurtz has described the preparation and properties of the above compounds belonging to a class of substances to which he has given the name of compound ammonias (ammoniaques composées).

Methylamine.—The process by which this base was obtained does not differ from that employed by chemists in preparing ammonia. Perfectly dry hydrochlorate of methylamine is mixed with twice its weight of quicklime, and the mixture is introduced into a long tube closed at one end, so as to occupy half of it. The other half is filled with fragments of potash, to which a tube is adapted for conveying the gas to an air-jar filled with mercury. The tube is to be slightly heated, beginning at the closed end; methylammoniacal gas, displaced by the lime, is abundantly liberated, and received in the air-jar filled with mercury.

Methylamine thus prepared is a non-permanent gas. At about 32° F. it condenses into a very moveable liquid. Its odour is strongly ammoniacal. Its density was found to be 1.13; it is, therefore, rather more dense than atmospheric air. The experimental result is rather higher than the theoretical, which is 1.075. This is undoubtedly owing to the temperature at which the experiment was made, the gas being too near its point of liquefaction.

Methylammonia gas is the most soluble of all gases hitherto known. At the temperature of about 53° F. one volume of water dissolves 1040 volumes; a higher temperature diminishes this solubility, as might be expected. At 77° F. water dissolves only 959 times its volume.

Like ammonia, it is instantaneously absorbed by charcoal, and also resembles it in immediately rendering litmus paper blue; when exposed to the vapour of hydrochloric acid it forms a very thick white smoke. Like ammonia, it absorbs an equal volume of hydrochloric acid gas, and half its volume of carbonic acid gas. It is distinguished from ammoniacal gas by the circumstance that, when exposed to flame, it takes fire and burns with a yellowish flame.

The composition of methylammonia gas is represented by $C_2 H_5 N = 4$ vols.

An elegant and rapid analysis of this gas is effected by heating it with potassium in a bent tube. Cyanide of potassium is formed and hydrogen is evolved, $C_2 H_5 N + K = C_2 NK + H_5$.

The solution of methylamine has the strong odour of the gas itself. Its taste is caustic and burning. Iodine reacts upon the solution of methylamine, and is converted into a powder of a garnet-red colour; and the liquor, which hardly becomes coloured, contains hydriodate of methylamine, $IH, C_2 H_5 N$. The red insoluble compound formed as described is analogous to iodide of nitrogen.

The salts of magnesia, alumina, manganese, iron, bismuth, chromium, uranium, tin, lead, and mercury, are precipitated by methylamine as they are by ammonia.

The salts of zinc are at first precipitated, and of a white colour; but the precipitate redissolves in a large excess of the reagent; the salts of copper are precipitated of a bluish-white colour; excess redissolves the precipitate, forming a solution of a deep blue colour; the salts of cadmium, nickel, and cobalt, are precipitated by the solution of methylamine, but excess does not redissolve the precipitates.

Nitrate of silver is completely precipitated by methylamine; the oxide of silver dissolves readily in an excess of the reagent. When this solution is suffered to evaporate spontaneously a black substance is precipitated, which is analogous to fulminating silver. This substance does not explode even by a blow, or by the action of heat; chloride of silver itself dissolves in solution of methylamine.

Chloride of gold is precipitated of a brownish yellow; an excess readily dissolves the precipitate, forming an orange-coloured solution. A concentrated solution of chloride of platina gives with methylamine a crystalline deposit in orange-coloured scales, consisting of a double hydrochlorate of methylamine and platina.

Ethylamine.—This base was obtained by decomposing hydrochlorate of ethylamine by lime, in the same manner as methylamine. Excepting that as ethylamine condenses readily, and is liquid at common temperatures, the delivery-tube is surrounded with ice, or, still better, by a freezing mixture; the ethylamine distilled at a moderate heat condenses in the receiver.

In a pure state it is light, very moveable, and perfectly limpid liquid. It boils at about 64° F. When poured on the hand it volatilizes, instantly producing very considerable cold. It gives out an extremely penetrating ammoniacal odour; its causticity may be compared to that of potash. Ethylamine renders litmus paper which has been reddened strongly blue; when exposed to hydrochloric acid it yields dense white vapours. Every drop of acid added to it produces a whistling at the moment of its mixing with the base. Barytes and potash remain in contact with it at common temperatures without alteration. When exposed to flame, ethylamine takes fire and burns with a bluish flame. It mixes with water in all proportions, giving out much heat, and yielding a solution the basic properties of which are exactly similar to those of methylamine; hydrate of copper is, however, most readily soluble in ethylamine.

Chloride of platina is not precipitated by ethylamine. When a solution of ethylamine is mixed with oxalic ether, the mixture soon becomes turbid; alcohol is formed; very slender crystals separate of a compound which is to oxamide what ethylamine is to ammonia. It is ethyloxamide, the composition of which is represented by $C_6 H_6 N_2 O_2$. The composition of anhydrous ethylamine is represented by the formula $C_4 H_7 N$.

100 parts give:—

	Experiment.		Theory.
Carbon	54.4	..	54.3
Hydrogen	15.9	..	15.5
Nitrogen	30.9	31.3	31.2

Comptes Rendus, August 13, 1849.

ON VALERAMINE OR VALERIC AMMONIA.

By M. ADOLPHE WURTZ.

M. A. Wurtz states that cyanate of amylene, which he obtained by distilling sulphamylate of potash with cyanate of potash, is easily decomposed by solution of potash. The reaction, favoured by the action of heat, gives rise to carbonate of potash and a volatile base, valeramine, which distils when the solution of potash is boiled. It is found in the receiver in solution in water which is volatilized and condensed with it.

On saturating this solution of valeramine with hydrochloric acid, a perfectly neutral hydrochlorate is obtained, which by evaporation is obtained in the form of white scales, greasy to the touch, very soluble in water and soluble in alcohol; it does not deliquesce in the air. By analysis it yielded:—

	Experiment.	Calculation.
Carbon	48.2	48.5
Hydrogen	11.4	11.3
Chlorine	28.3	28.7
Nitrogen	..	11.5

This analysis agrees perfectly with the formula $HCl\ C_{10} H_{13} N$.

The accuracy of this formula was verified by analyzing the double salt which is precipitated when concentrated solutions of chloride of platina and hydrochlorate of valeramine are mixed. As it is considerably soluble in water, it is advantageous to add a little alcohol to the mixture. After having collected and pressed the precipitate, it is to be redissolved in boiling water; on cooling, it precipitates in fine scales of a golden-yellow colour, the composition of which is represented by the formula $HCl, C_{10} H_{13} N, Pt Cl_2$, as deduced from the following results of the analyses:—

	Experiment.	Calculation.
Platina	32.6	32.9
Chlorine	36.0	36.5
Carbon	20.4	20.5
Hydrogen	—	—
Nitrogen	4.8	4.8

When hydrochlorate of valeramine is distilled with lime, the volatile valeramine passes over into the receiver. When pure, this base is liquid; its taste is both burning and bitter, and its odour strongly ammoniacal. It is soluble in water, and the solution precipitates the salts of copper, an excess redissolving the precipitate, yielding an azure-blue solution; this effect is, however, produced with greater difficulty than with ethylamine, methylamine, or ammonia.

Valeramine also precipitates nitrate of silver; the precipitate is of a fawn colour, and adheres like a resinous mass to the bottom of the vessel. An excess of the reagent whitens and completely dissolves it. Chloride of silver is dissolved by valeramine, but with more difficulty than by ammonia.—*Comptes Rendus*, Aug. 13, 1849.

ON THE COMPOSITION OF THE BILE OF THE GOOSE.

By TH. MARSSON.

The animals, the bile of which formed the subject of the present investigation, we fed upon oats. Immediately after its removal from the gall-bladders, the bile exerted a slightly acid reaction. It possessed a somewhat peculiar fatty odour, and a very intense dark green clour, and was of a somewhat thickish consistence. Still in no case could it be drawn into threads, although this might be done at a very low temperature. When treated with acetic or muriatic acid, a precipitate was immediately formed.

The average weight of the contents in eight gall-bladders was 3 grms.; the weight of the entire animal, including the feathers and blood, amounted on the average to 16 lbs.

Solid Constituents.—On drying the entire bile, in two separate instances, at 212° F., the results given under I. and II. were obtained; and on drying a portion of a mixture of the contents of eight gall-bladders at 266° F. the results given under III. were found:—

	I.	II.	III.
Solids.....	20.13	19.40	19.98
Water.....	79.87	80.60	80.02
	100.00	100.00	100.00

Inorganic Constituents.—The above specimens of bile, after having been dried in a platinum crucible, were incinerated. The ash was white, fused at a red heat, and effervesced with acids; the nitric solution yielded precipitates with nitrate of baryta and nitrate of silver, which were not soluble in excess of the acid; ammonia produced a gelatinous precipitate of phosphate of magnesia. It consisted essentially of carbonate and phosphate of soda, with some chloride of sodium and phosphate of magnesia. The ash of the three specimens of bile enumerated above amounted respectively to 2.04, 1.85, and 2.08 per cent. of the fresh undried bile.

Biliary Mucus.—When the bile was treated with 2 vols. of alcohol of 0.833 spec. grav. until any further precipitate ceased to be formed, it yielded on filtration a beautiful dark green solution; and the mucus, after having been washed on a weighed filter, first with dilute alcohol, and subsequently with alcohol of 0.833 spec. grav. until the latter passed through the filter in a colourless state, was of a dirty green colour, and amounted to 2.56 per cent. of the weight of the fresh bile.

Fatty Matter.—The bile which had been treated in the above manner, on exhaustion with ether, yielded the small amount of 0.36 per cent., of which cholesterine appeared to constitute a part; the ether at the same time acquired an acid reaction. Hence the proximate constituents of the bile of the goose are as follow:—

Fatty matter and cholesterine..	0.36
Mucus	2.56
Pure bile and colouring matter	17.06
Water	80.02
	100.00

The Pure Bile (Chenocholeate of Soda).—The bile, when freed from the fatty matter and mucus, contains a remarkably large amount of colouring matter, which is difficult of separation. The alcoholic solution of the bile, when dried at 230° F., left on resolution in absolute alcohol a somewhat considerable amount of a greyish-brown plastery mass, consisting of some bile and a large quantity of colouring matter. After the evaporation of the solution, the separation of the fatty matter from the residue by ether, and the resolution of the latter in alcohol, the liquid could not be completely decolorized by treatment with good animal charcoal. On evaporation and desiccation at 212° F., the pure bile is obtained in the form of a readily-pulverized mass, which yields a yellow powder. Its aqueous solution was strongly acid, tasted at first sweet and then strongly bitter, and differed essentially from the bile of the ox and pig in its behaviour towards reagents. Not the slightest precipitate was produced by either acetic acid, oxalic acid, nitrate of silver, acetate of lead, or bichloride of mercury, even on the application of heat, or after having been set aside for twenty-four hours. The fresh bile is precipitated by acetic acid; but this precipitation only arises from the mucus, after separation of which no further precipitation occurs. Chloride of barium, chloride of calcium, and muriatic acid immediately produce copious precipitates. These are white when first thrown down; but, on agitating the vessel, they soon adhere in a plastery form to its walls. The barytic precipitate is dissolved by ebullition, even after the addition of ammonia, but again separates on cooling. Acetate of lead also causes a copious plastery precipitate, which is neither dissolved by excess of the precipitant nor on ebullition. The bile of the goose also yields the violet colour with sugar and sulphuric acid discovered by Pettenkofer.

On dissolving the pure bile in alcohol of 0.833 spec. grav., and adding hydrated ether, a precipitate is formed, which, after a considerable lapse of time, becomes converted into crystals, which is dependent upon the quantity of water existing in the liquids. When the solvents are concentrated it remains plastery. The ash of the pure bile of the goose consisted principally of carbonate and sulphate of soda, with traces of sulphate of lime, phosphoric acid, and chlorine.

The determinations of the sulphur in this bile show that it is one of those most abounding in this substance. Its deportment with the above-mentioned reagents, as also the crystallizability of the pure bile, which is the soda salt of what is very probably a new acid, perhaps closely allied to the choleic acid of Strecker, justify us in distinguishing this acid provisionally from the other allied biliary acids by the name of chenocholcic acid. The purified bile, dried at 230° F., has, according to the author's analyses, the composition expressed under I. Hence the constituents of the organic matter combined with the soda are those detailed in II.:—

				I. Pure bile.	II. After deducting the NaO.
Carb.....	..	..		57.19	60.06
Hyd.....	..	..		8.39	8.81
Nitrogen.	..	..		3.48	3.66
Sulph. ..	6.45	6.23	mean 6.34		6.66
Oxygen..	..	..		19.82	20.81
NaO ...	..	..		4.78	—
				100.00	100.00

Ash . .. 9.55 9.65 per cent.

Archiv. de Pharm., lviii., 138-148, and *Chem. Gaz.*

RESEARCHES UPON THE ARTIFICIAL PRODUCTION OF SOME MINERAL AND CRYSTALLINE SUBSTANCES, ESPECIALLY THE OXIDE OF TIN, THE OXIDE OF TITANIUM AND QUARTZ.

By M. A. DAUBREE.

Production of the Oxides of Tin and Titanium and Silicic Acid in a Crystalline Form.—In a memoir which was submitted to the Academy in 1841 I showed that the fluorides appeared to have played a generating part in the formation of stanniferous deposits. That idea, which at the time was only based upon observations on the structure and the composition of the tin deposits, is now confirmed by experiment; for, on imitating the natural process which I pointed out, I obtained the oxide of tin in a crystallized state. Except that, instead of operating upon the fluoride, the preparation of which requires apparatus which is not at my disposal, I used the chloride. Moreover, the great analogy of the fluorides and chlorides allows us to extend the results obtained with the latter to the corresponding fluorides.

The process consists simply in conducting into a porcelain tube heated to redness two currents, one of perchloride of tin, the other of aqueous vapour. The stannic acid which results from the mutual decomposition of the two vapours is deposited in little crystals, which line the orifice of the porcelain tube. Larger crystals are obtained by using the perchloride of tin dissolved in a current of dry carbonic acid, instead of vaporizing the former substance by the mere action of heat.

The crystals of the oxide of tin, as thus obtained, are mostly colourless, possess the adamantine lustre peculiar to natural crystals, and are sufficiently hard to scratch glass with ease. Although very small, their facets and edges are perfectly distinct. They are right rhombic prisms, always very much flattened in one of the horizontal dimensions by two vertical facets of truncation. The bases of the primary prism do not exist, each of them being replaced by a pair of symmetrically-placed facets (biseaux). The angles of the extreme summit of these crystals, the only ones which the minuteness of the facets permits to be measured by the reflecting goniometer, are respectively 133° and 89°. Being derived from the right rhombic prism, these crystals do not belong to the same crystalline system as those of the native oxide of tin, which belongs to the octohedron with a square base. Consequently the oxide of tin constitutes a new instance of dimorphism. These rhomboidal crystals of the oxide of tin present most resemblance in their crystalline system, their modifications and their physiognomy to those of Brookite, which is one of the three native forms of titanic acid. Like the crystals of Brookite, the crystals of the oxide of tin present longitudinal striæ parallel with the vertical angles of the primary prism. The similitude is completed by the angle of the two facets, which is 133° in the rhombic oxide of tin, corresponding to the angle (e_3 upon e_3) of Brookite, which, according to Levy, amounts to 134°. Hence the rhombic oxide of tin as obtained artificially is isomorphous with Brookite.

It has long been known that the native oxide of tin is isomorphous with rutile. The results which have been detailed teach us further, that the two primary forms of stannic acid correspond exactly with the two forms of titanic acid. This isodimorphism furnishes a new remarkable instance of the geometric relation which connects the two primary forms of a dimorphous substance. The specific gravity of the rhombic oxide of tin, which is 6.72, is inferior to that of the tetragonal oxide of tin. The same applies to the density of Brookite in comparison with that of rutile. In the two isodimorphous substances in question, the form of the square prism corresponds to a denser molecular aggregation than that of the right rhombic prism. Because the oxide of tin obtained by the action of the vapour of water upon the vapour of the perchloride of tin has not the same form as the natural oxide of tin, we ought not to conclude that these two systems of crystallization correspond to methods of generation which are very distinct from each other; for in Oisans and Switzerland the same veins, and sometimes the same specimens, contain at least two of the species of titanic acid, anatase, and Brookite. Hence circumstances very intimately related to each other may give rise to the change of molecular equilibrium which the two forms of titanic acid exhibit.

The vapour of the perchloride of titanium, when treated by the same two processes as those to which the perchloride of tin was submitted, also furnishes titanic acid in little tubercles studded with perfectly distinct crystalline points, but the dimensions of which are microscopic. These minute crystals appear to have the same form as stannic acid when crystallized artificially.

The chloride and the fluoride of silicium have been treated by the same processes. As the employment of the porcelain tube did not yield perfectly satisfactory results, I repeated the decomposition of the two vapours successively in an earthen retort and in a crucible, both of which were raised to a white heat. In two of these experiments I obtained with the chloride of silicium a deposit of silica with a vitreous fracture, the tuberculated surface of which presented here and there very minute crystalline facets, among which triangular facets similar to those of quartz were visible. The crystallization of quartz is much more difficult of accomplishment than that of titanic acid, and especially than that of the oxide of tin.

In the experiments which have been detailed the porcelain tube was heated to a white heat; but the crystalline deposit of the stannic, titanic, and silicic acid occurs at that end of the tube where the two vapours are conducted, and in the part outside the furnace. The temperature of this portion of the tube did not exceed 590° F. *Comptes Rendus*, Aug. 27, 1849.

ON THE SULPHITE OF THE PERCHLORIDE OF PHOSPHORUS.

By P. KREMERS.

According to H. Rose, a combination of sulphuric acid with perchloride of phosphorus is obtained when sulphuric acid and protochloride of phosphorus are brought together, the latter being oxidized at the expense of the sulphuric acid. I have succeeded in preparing a similar compound by bringing together the same elements, only otherwise grouped. When, for instance, a current of dry sulphurous acid is passed over perchloride of phosphorus, these two substances combine, with considerable evolution of heat, into a greenish liquid. On rectifying it, a portion of the sulphurous acid escapes, and the distillate corresponds in composition to the formula PCl_5, $2SO_2$,* and has the following percentage composition:—

P = 11.73	The formula PCl_5, $2SO_2$	gives	11.71
Cl_5 = 64.24	"	"	64.87
S_2 = 12.23	"	"	11.71
O_4 = 11.80	"	"	11.71

This limpid, highly hygrometric compound, which is very troublesome to the eyes and organs of respiration, surpasses in refractive power the sulphuret of carbon, with which it has in common the property of dissolving iodine with a red colour. Its specific gravity at 57° F. was found to be 1.667; it boils at 212°. When poured into water, it sinks in drops to the bottom, like the sulphate of the perchloride of phosphorus, and is gradually decomposed into sulphurous, muriatic, and phosphoric acids. No sulphuric acid is formed on this occasion. This behaviour towards water was turned to account for its analysis, the sulphurous being converted by chlorate of potash into sulphuric acid. This compound dissolves a tolerable quantity of perchloride of phosphorus, which, on being set aside at the ordinary temperature, separates after some time in transparent square prisms, whilst according to H. Davy it crystallizes on fusion in columnar prisms. The mother-liquor from which the crystals had separated yielded on analysis results which also corresponded to the formula $PCl_5, 2SO_2$:—

P = 12.12	The formula $PCl_5, 2SO_2$	gives	11.71
Cl_5 = 65.48	"	"	64.87
S_2 = 11.44	"	"	11.71
O_4 = 10.96	"	"	11.71

On comparing the last analysis with the first, it is found that the calculated formula is situated nearly between the two. In the first, the amount of sulphur and oxygen, in the second, that of the phosphorus and chlorine, is somewhat higher than required by theory; undoubtedly because in the first some sulphurous acid, and in the last some perchloride of phosphorus, are retained in solution; at least I found, after repeating the distillation, 0.4 per cent. less of sulphur in the first than the sample had previously yielded. Consequently to obtain this compound pure it must be submitted to a second distillation. When sulphurous acid is passed through this compound, it absorbs another equivalent, which, however, is held in weak combination, and escapes even at the ordinary temperature, and still more readily at a gentle heat, which renders its analysis somewhat difficult. It furnished:—

P = 10.86	The formula $PCl_5, 3SO_2$	gives	10.48
Cl_5 = 59.07	"	"	58.08
S_3 = 15.88	"	"	15.72
O_6 = 14.19	"	"	15.72

It differs from the preceding by its lesser specific gravity and refractive power.

When ammonia is passed over the sulphite of the perchloride of phosphorus, the same phenomena are observed as when its constituents are treated separately with ammonia. There are obtained chloride of ammonium, dry bisulphite of ammonia, and a white powder, which does not differ from that obtained by treating perchloride of phosphorus with ammonia. A preliminary examination of the substance, dried at 212°, gave, however, only 36.18 per cent. phosphorus.—*Liebig's Annalen*, June, 1849, and *Chem. Gaz.*

* This compound has recently been prepared by Persoz.

NOTICE RESPECTING DU BOIS REYMOND'S DISCOVERY OF THE DEVELOPMENT OF ELECTRICITY BY MUSCULAR CONTRACTION.

By Prof. BUFF, of Giessen.

The remarkable observation made by Du Bois Reymond, that an electric current can be excited by muscular contraction, has been called in question by Messrs. Despretz and Becquerel, who did not succeed in obtaining favourable results on repeating the experiment. Under these circumstances it may prove of interest to describe a few experiments which I have made with a better result.

The galvanometer employed was constructed by Kleiner, of Berlin; it had 3,000 convolutions of a copper wire one fifth of a millimetre in thickness. The extremities of this wire were connected, according to Du Bois Reymond's directions, with strips of platina cut out of the same sheet of metal; each strip dipped permanently into a vessel containing a saturated solution of common salt. Notwithstanding this precaution it was found impossible to obtain an absolute and permanent uniformity of the two strips. However, on immersing the fingers in the salt water, in general only a faint current, which soon decreased, was developed; but it was of such extent that the needle seldom came to perfect rest. By bracing the muscles of the hand and arm only doubtful effects were obtained, precisely as was found by the French experimenters. As the needle oscillated somewhat rapidly, seven to eight seconds to one oscillation, I endeavoured to render its astatic system more perfect, and succeeded in reducing the time of vibration to thirty seconds, *i.e.*, in increasing the sensitiveness of the needle nearly sixteen times.

Nevertheless, the influence of the muscular contraction was scarcely rendered more perceptible. Sometimes it was more, sometimes less, obscured by accidental deflections of the needle, which it becomes the less possible to control the more the magnetic directive force has decreased. Very little was, therefore, to be expected from continuing to perfect the astatic system, at least with the multiplier in use, the wire of which did not appear to be entirely free from iron. Du Bois Reymond obtained a higher degree of sensitiveness by means of a larger number of convolutions, which is evidently preferable in experiments of this nature.

One method of observing the phenomenon discovered by Du Bois Reymond with less sensitive instruments is by increasing the electromotive action excited by muscular exertion. Sixteen persons who took part in this experiment held each other's moistened hands, and on all contracting simultaneously the right, or simultaneously the left, arm, they formed, as it were, a circuit of increased electromotive power. The effect on the needle was now perfectly evident, and opposite according as the right or left arm was contracted; the direction of the current was always from the hand to the shoulder. It is essential that the muscular contraction should be increased, or at least continued, until the needle begins to return, and then suddenly discontinued. Although it was found impossible to produce a greater deflection than 10° to 12°, the corresponding intensity of the current was sufficient to overcome any accidental influences; nay, even to stop a movement in the opposite direction and to reverse it.—*Liebig's Annalen.*

OBSERVATIONS ON THE VOLTAIC ARC.

By M. MATTEUCCI.*

I have studied the calorific and luminous phenomena of the voltaic arc, and the transference of matter, with the aid of the electro-magnetic machine, which is now generally employed in the application of electricity for medical purposes. With this instrument, which acts for several days with a few of Bunsen's or Grove's cells, there is between a point and a slip of platina a continual series of electric sparks corresponding to the very close interruptions of the circuit. On observing the phenomenon with the naked eye, the arc of light would be thought to be continuous; but by looking upon a disc, the surface of which is painted with black and bright rays, rotating with a certain velocity, it is easy to be convinced of the discontinuity of this electric light.

In all my experiments I employed two similar points of platina, or of another metal, instead of a point and the plate, as extremities between which the spark should be emitted.

I first examined the temperature of the two metallic points at the moment the electric arc was produced; and for this purpose made very near to the extremities of the points a hole which was scarcely one millimetre in diameter, and into which was inserted the point of a thermo-electrical clasp of iron and copper in communication with the galvanometer. When the experiment is carefully performed, so as to have a continuous series of sparks accompanied by a constant sound, there is also a fixed deflection of the galvanometer. I have in this manner proved and measured the difference of temperature of the positive point compared with that of the negative point, the latter being always lower. The difference varies with the metals, as was to be expected. I found it greatest with iron and copper, iron and platina; and less with lead, bismuth, and zinc.

I then studied the luminous phenomena of this electric arc, which in this case was of importance, as Dr. Neef, of Frankfort, had never observed any light except at the negative pole. According to that author, with a very weak current there is constantly and only at the negative pole an electric light, which he calls primary, from its being, in his opinion, independent of the presence of the matter of the poles.

I made a long investigation of the voltaic arc obtained with the electro-magnetic machine, observing it with the aid of a microscope which magnified from forty to sixty times. The experiment, which is very beautiful and important, succeeds best on employing iron or platina points and a very feeble current. The following are the phenomena which I constantly observed:—

1. The positive extremity is distinctly seen only in the state of incandescence; globules of red molten matter roll over its surface, which

* From the "Comptes Rendus" for September 3, 1849, and "Phil. Mag."

separate from it, leaving cavities, and are projected on to the negative point, where they form mushroom-like excrescences. By compelling the two iron points to remain in contact, it is very beautiful to observe the formation in the centre of a double cone of incandescent lava of a very brilliant light; and which, resting by its bases upon the two metallic points, evidently flows from the positive to the negative pole.

2. A diffuse light is perceived similar to a flame or luminous cloud, but transparent, enveloping the two points; this light varies in colour with the nature of the metals, and resembles every other electric light produced between different metallic points. Thus it is green with copper, of a dirty yellow with zinc, and violet with platina and silver.

3. This light or flame is constantly traversed by sparkling points, similar to those which are produced by hammering hot iron: these sparks are principally produced with the iron points, and are always seen to glow outside of the electric flame.

4. Lastly, some very brilliant and mobile luminous particles, and which seem always to congregate towards the extremity of the point, appear constantly and only at the negative pole. The observation of Dr. Neef is, as regards this, perfectly accurate: it is requisite only to change the direction of the current to observe this light immediately spring from one pole to the other. If there is a drop of oil between the points, the light of the negative pole is concentrated at the extremity only, just as with an exceedingly weak current. If a somewhat powerful current be employed, the phenomena described are no longer seen distinctly, and the two poles then appear to be equally luminous.

I have likewise studied the transference of matter by the spark between the two metallic extremities, and employed for this purpose a plate and a point of similar or dissimilar metals, making the plate sometimes positive and sometimes negative. I examined only the plate with the microscope after the experiment; in every case there was a transference of the positive on to the negative metal, and *vice versâ*. The circular stain which is formed upon the plate is composed of the central part, where signs of fusion are apparent, and where the metal transferred from the other pole is deposited; around this central portion there is a radiating circle of a more or less dark colour, which varies with the nature of the metals. When the plate is positive, the marks of fusion are greater, and the stains of the metal transferred from the negative pole are scarcely perceptible, whilst the border, of a dark colour, is very large. The reverse occurs when the plate is negative. When a drop of gum-water or of turpentine is interposed between the point and the plate, it soon becomes charged with a black powder consisting of finely-divided metal, and the mark formed on the plate has no border.

My principal object in making these researches being the examination of the production of light at the negative pole, in order not to have recourse to the hypothesis entertained on this subject of the light being produced by one pole and the heat by the other, I made a large number of experiments with the positive and negative points of two different metals. I found that the fixed light at the negative pole is never produced without the presence of a platina point at the positive pole, and in this case the nature of the metal of the negative point is indifferent; on the contrary, if the negative point is of platina, and the positive pole is terminated by points of iron, copper, zinc, or silver, the fixed light no longer exists on the negative point, or at all events the phenomenon becomes much confused. I was thus led to suppose that the phenomenon, being dependent on the nature of the metals, and produced principally with platina, was owing to the positive pole becoming more heated, and to the particles detached from this pole, and transferred to the negative pole, becoming incandescent from their very small size. It is evident that with metals which readily oxidize and burn in the air these phenomena are no longer produced in the same manner as with platina.

There still remained to ascertain the cause of this unequal heating of the substance of the two poles. The voltaic arc which I studied is produced in a circuit which is sometimes formed by the contact of the two points, and at other times imperfectly established by the transference of matter with the spark. I passed an electric current produced by a constant battery through two cylindrical rods of iron or lead, which were in contact at their bases. Each of these rods had near its base a very small hole, into which was inserted a thermo-electrical clasp communicating with the galvanometer. I was thus able to measure the temperature developed by the passage of the current in the metallic rod near the place of interruption, or, more exactly, near the ends of the two rods in contact. With this arrangement I was easily able to convince myself that the temperature developed by the passage of the current was at its maximum near the place of interruption; and that, in order to cause this temperature to vary, it sufficed to alter the reciprocal pressure of the two rods. In proportion as the pressure decreased, without any perceptible alteration in the electric current, the temperature of the rods constantly rose. Thus the thermo-electric current developed by the clasp, being from ten to fifteen degrees when the two rods were pressed hard one against the other, rose from sixty to seventy degrees when this pressure was diminished. In like manner the disengagement of heat varies considerably when the surface of the bases of the rods in contact is either oxidized, polished, or covered with a very thin layer of graphite, oxide of iron, &c. The heat developed is always increased by the oxidation or coating of the surface of the rods with graphite powder. In this case the hottest extremity is always that communicating with the positive pole; and the most favourable case for obtaining the greatest difference of temperature between the positive and negative pole is that in which, the surface of the negative extremity being coated with oxide or graphite powder, that of the positive extremity has remained bright. Connecting this fact with that previously mentioned concerning the unequal heating of the two poles, it becomes evident that, since by the transference of matter from the positive to the negative pole the surface of the two poles experiences a different alteration, and that the greatest change takes place at the negative pole, the difference of temperature must be due, at least in part, to the difference of alteration of the surface, which is a consequence of the fact of the transference. I hope to have thus shown, experimentally, the connection which exists between the phenomena of the voltaic arc; and I am led to consider them as depending on the transference of matter from the positive to the negative pole. On the other hand, we know from the experiments of MM. Poiret and Becquerel, that the transfer of matter from the positive to the negative pole is a phenomenon independent of the development of heat by the electric current.

GOLD IN CERTAIN MINES OF THE DEPARTMENT OF THE RHONE.

MM. Allain and Bartenbach state that the copper mines of Chessy and of Saint Bel (Rhône) have been the objects of interesting experiments; the result of which is, not only that the copper and zinc which the pyrites contains may be easily extracted, but that it contains also at least 1-10,000 of gold. According to analyses, the numerical results of which are not stated by the authors, the pyrites contains sulphur, iron, zinc (about 8 per cent.), copper (about 5 per cent.), silica, arsenic, and gold, 1-10,000 at least. This discovery of gold has naturally led to the performance of a series of operations, in order to find an economical method of extracting this metal. Although the experiments are not entirely finished, the authors consider that the separation of this small quantity of gold is easy and economical, and that tne copper, zinc, and sulphuric acid obtained will partly cover the expenses of extraction; the method is briefly as follows:—The sulphur and arsenic being expelled by roasting, and the oxides of zinc and copper formed dissolved by sulphuric acid, the residue, which is composed of silica, sesquioxide of iron and gold, is to be washed, and then treated with a cold aqueous solution of chlorine; after some hours' action a solution of chloride of gold is obtained, from which the metal is reduced by the usual processes; the chlorine in this case does not act upon the sesquioxide of iron.—*L'Institut*, Août 8, 1849.

ON THE ANALYSIS OF PLANTS BY INCINERATION.

By M. CAILLAT.

The author, who is professor at the Agricultural Institute of Grignon, is of opinion that incineration, generally hitherto employed for obtaining the inorganic matters of plants, yields incorrect results; that the sulphates contained in the plant so treated are in great measure decomposed, and that the sulphuric acid or sulphur escapes in large proportion among the gaseous products of combustion.

It occurred to M. Caillat to treat the residues of plants, such as lucern, trefoil, and sainfoin, with dilute nitric acid, and he succeeded in separating almost the whole of the mineral substances which they contained; so that the pulpy residue of 10 grammes of the substance employed, after washing and drying, burnt readily, leaving only 18, 20, or 22 milligrammes of ashes. This small residue consisted of silica and a little peroxide of iron, substances both insoluble in the acid employed. This method of treating plants always yielded the author a larger proportion of mineral substances than he obtained from the same quantity of the same plants by incineration; and in certain vegetables he found a much greater quantity of sulphuric acid than has hitherto been stated.

M. Caillat states that he found by experiment that the loss of sulphuric acid occasioned by incineration is derived from the decomposition of a part of the sulphate of lime. Thus on intimately mixing with starch and water a known quantity of pure and calcined sulphate of lime, and incinerating the mass, the collected ashes did not contain as much sulphuric acid as the sulphate of lime employed.

The author has also stated another direct experiment, which shows that the sulphate of lime converted into sulphuret of calcium by the influence of the inorganic matter, at a high temperature, is partly converted into carbonate of lime by the action of the oxygen of the air. The oxygen gas, burning at once the sulphur of the sulphuret and a portion of carbon interposed, forms sulphurous acid, which is evolved, carbonic acid, part of which remains combined with the lime, facilitating thereby the displacement of the sulphur.—*L'Institut*, Août 8, 1849.

ON THE DETECTION AND ESTIMATION OF PHOSPHORIC ACID.

By C. LECOMTE.

The detection of phosphoric acid by the reagents hitherto employed is accompanied with considerable difficulty. Having examined the behaviour of almost all the known oxides towards phosphoric acid, the phosphate obtained with the oxide of uranium was found to exhibit a great superiority over all the others with respect to its almost absolute insolubility in water and the rapidity with which it is deposited, leaving the liquid perfectly transparent.

Numerous experiments have demonstrated the certainty with which the soluble salts of uranium detect the presence of phosphoric acid wherever they meet with it. The two following facts, confirmed a large number of times, may suffice to prove this.

I. 0.05 grm. of syrupy phosphoric acid added to four litres of distilled water furnished with nitrate of uranium a very copious precipitate on ebullition; salts of soda, potash, ammonia, lime, and magnesia (in the two last cases the liquid was acidulated so as to keep it transparent) added to the preceding liquid do not prevent the precipitate being formed; the same salts added to distilled water do not precipitate the nitrate of uranium.

II. Phosphate of lime dissolved in hydrochloric acid, and the liquid highly diluted, furnished a very copious precipitate with it.

The determination of the amount of phosphoric acid in the soluble phosphates is very simple. A solution of nitrate of uranium is made, each cubic centimetre of which precipitates 0.001 grm. of phosphoric acid; a known weight of the phosphate for analysis is taken and dissolved in a known volume of distilled water, carefully neutralizing; 50 cub. centim. of this liquid are heated to boiling in a small flask, and the nitrate of uranium poured into it from a graduated burette until the liquid above the precipitate is perfectly clear, taking care to boil it for a second after each addition of the normal solution.

In a subsequent paper I shall describe a process for the estimation of phosphoric acid in the insoluble phosphates by means of the nitrate of uranium.—*Comptes Rendus*, July 16, 1849, and *Chem. Gaz.*

COMPARATIVE STUDY OF THE AURIFEROUS SANDS OF CALIFORNIA, NEW GRANADA, AND OF THE OURAL.*

By M. DUFRENOY.

The French Consul at Monte Rey has forwarded to the Minister for Foreign Affairs a collection from the gold workings in California; a portion of this collection has been sent to the Ecole des Mines, and I have had an opportunity of examining it. It comprises:—

1st. Two samples of auriferous earth taken from the surface of the ground, in two parts of the Valley of Sacramento.

2d. Auriferous sand, resulting from very thoroughly washing the same earth, and in which bracteæ of gold are distinctly visible.

3d. Pieces of quartz and fragments of rocks collected in the alluvion which constitutes this valley.

4th. Two pieces of native gold.

5th. Lastly, bracteæ of gold from three different parts of the Sacramento, namely, from the American river at its entrance into the Valley of Sacramento; from the same river at 48 kilometres (about 30 miles) from its mouth; and from the River de las Plumas, from 60 to 72 kilometres (37 to 45 miles) distant from the first. These three points make known nearly one fifth of the Valley of Sacramento, which commences in the Sierra Nevada (Snow Mountains), and terminates in the ocean at the Port of San Francisco. Its course, which is nearly east and west, is from 336 to 360 kilometres long (210 to 225 miles).

The bracteæ of gold from California are much larger than those of the washings of the Oural and Brazil. They likewise differ from them in their reddish colour, which enables us to distinguish them at first sight; their composition, according to the analysis made by M. Bivot,† is:—

Gold	90.70
Silver	8.80
Iron	0.38

The earths of the Valley of Sacramento are light; to the touch they are very soft, but rubbing on the hand discovers some rough particles; their colour is a light brown; the microscope shows them to be almost entirely siliceous; the small fragments of which they are composed are angular and transparent; they very readily collect in lumps, and resemble, in colour and transparency, a saline mass: by the naked eye only very few distinct grains are visible.

The piece of gold sent to the Ecole des Mines weighs 47.9414 gr. (about 740 gr.); its colour is reddish; its composition is very analogous to that of the gold in bracteæ. This piece adheres to milky white quartz, whose surface resembled that of pebbles, washed in a river; however, it retains its general form, which is that of a thick, flat, and irregular vein.

The form of this piece and the presence of quartz show us that, in its primitive situation, the gold forms veinules with a quartzy gangue.

The schistous fragments which exist in the alluvion of the Valley of Sacramento lead us to imagine that the mountains which contain the auriferous veins are rather micaceous schist than granite properly so called; this conclusion likewise flows from the examination of the washed auriferous sands.

NATURE OF THE AURIFEROUS SANDS OF CALIFORNIA.

The general colour of these sands is black. It is perceived at the first glance that oxide of iron predominates in them, and that it is to that mineral that their colour is owing. I therefore commenced by separating the oxide of iron by means of the magnet: 3 grammes gave 1.79 gr. of oxide of iron, or 59.82 per cent. Notwithstanding the separation of this large proportion of oxide of iron, the sands retained their black colour; they were very rich in gold, and a greater number of bracteæ were observed in them.

Examined with the microscope, the sands remaining after the separation of the oxide of iron contained some octohedral crystals, some with reflecting and but little altered faces—others rounded, but still brilliant. These crystals, from their form, and the colour of their dust, appeared to be the titaniferous oxide of iron. They were mixed with flattened crystals, which, from their hexahedral projection and red dust, may be regarded as specular iron ore. Finally, among the black grains were observed very tender, dull, irregular fragments, which had all the characters of manganese.

The titaniferous oxide of iron predominated greatly in this second portion of the sands, the manganese, on the contrary, being much more rare; this second kind of oxide of iron was clearly distinguished from that separated by means of the magnet; the latter, fragmentary and tarnished, is rounded in some parts.

Mixed with the titaniferous oxide of iron, in the second portion of the sands of California, were found many white crystals of zircon, terminated at their two extremities, whose forms are very clear. These are—1. Four-sided prisms, surmounted by an octohedron with a four-sided base, placed on the angles. 2. The same prism, presenting, besides the octohedral points, facettes, *i*, resulting from the intersection of the common angle in this octohedron and the prism. 3. Prisms with eight faces formed by the two four-sided prisms M and h′. These crystals are generally very short. Their perfect transparency, with their total absence of colour, caused them to be taken, at first sight, for quartz; but, on counting the number of their faces, which it is very easy to do with some of them, it cannot be doubted that they belong to a prism with a four-sided base.

Notwithstanding their small dimensions, the clearness of these crystals is so perfect that the incidence of several of the faces may be measured. M. Descloizeaux found that the angle of *i* on *i* is 147° 30′, which differs only a few minutes from the value of the corresponding angle in the zircon. I was also able to observe the angle of the faces *i* on *i* and M on *i* in crystals of zicorn from New Granada, of which I shall speak further on. I obtained for their values 133° and 149°, which approximate to the values 133° and 148° 7′ given by Philips for the same angles.

A remark which appeared to me interesting, at least in the point of view of the power of crystallization, is that the crystals of zircon are often penetrated with other crystals which are entirely enclosed in it, as observed with the needles of titanium in rock crystal. These crystals, often of a milky white, or even colourless, are perfectly distinguished under the microscope by the different manner in which light falls on them. Some are of a hyacinth-red.

The white zircon, so abundant in the sands of California, is generally rough. I remember that it exists in some abundance in the Zillerthal, in the Tyrol.

The sands of California contain also colourless hyaline quartz and smoky hyaline quartz. This quartz, always fragmentary, is distinguished by its vitreous and conchoidal fracture; there are, indeed, remarked in it fragments of a light blue, which can only be corindon.

The grains of washed sand are generally 0m. 00005 in length, and 0.00001 in diameter. These dimensions admit of their being isolated, or, at least, easily grouped under the microscope. I profited by this circumstance to establish approximatively the proportion of the elements which I have just noticed: it was sufficient for me to calculate them. In the first operation I operated on only 560 grains; in the second, on 352. The mean of these two operations gave the following results:—

Oxide of iron obtained by the magnet	59.82
Titaniferous oxide of iron, specular iron, with a trace of oxide of manganese	16.32
Zircon	9.10
Hyaline quartz	13.70
Corindon	0.67
Gold*	0.29
	100.00

The difference which exists in the size and form of the grains, and that presented by the specific gravity of each of the elements of which the auriferous sands of California are composed, should cause these proportions to be considered as giving only a rough approximation to their composition. However, they correspond very well with the idea of its composition formed on looking at it, and are interesting from the indications which they furnish of the nature of the auriferous soil. It will be remarked, besides, that the specific gravity of the sands of California is about 4.37, and that the oxide of iron weighs 5.09. These numbers agree very well with the composition above indicated.

The crystalline state of the titaniferous oxide of iron and of the zircons show that the ancient soils whose destruction has produced the auriferous alluvion of the Valley of the Sacramento are not distant, and everything leads me to consider it as belonging to the chain of the Sierra Nevada. The perfect preservation of these crystals, and especially the particular circumstance of being terminated at their two extremities, makes me conjecture that these rocks are schistous. In the granites, indeed, the crystals adhere to the rock, and present only one summit; in schistous rocks, on the contrary, the crystals, very frequently lying in the direction of the stratification, are complete. Such are the staurotides and the disthenes of Saint Gothard, disseminated in the talcky schist, the macles of Coray in Brittany, and especially the small crystals of tourmaline so frequently met with in the micaceous schists of Morbihan. There is, therefore, reason to believe that the Sierra Nevada, or Snowy Mountains, which form the westerm limit of California, are, in great part, micaceous schist and talcky schist.

The interest I felt in the examination of the auriferous sands of California made me desire to compare them with the auriferous sands of several localities, and I have made a comparative study of the auriferous sands of New Granada, sent to me by M. Amedée Burat, and of the sands of the Oural, detailed by M. Le Play.

SANDS OF NEW GRANADA.

The sands of New Granada were collected in the Valley of Rio Dulce, situated in the province of Antroquia; they are almost entirely crystal-

* *Comptes Rendus*, No. 8, Aug. 20, 1849.

† "Annales des Mines," tome xiv., p. 105; 1848.

* The gold was determined by the dry assay.

line, like those of California. The forms of the crystals of titaniferous oxide of iron are even in a better state of preservation. These sands are rather gray than black; also the magnet gave me from 6gr. 70 of sand, only 2gr. 30 of oxide of iron, or 34.35 per cent.; there remained, after this first operation, a sand composed of titaniferous oxide of iron, specular iron, zircon, and quartz. The first two minerals, although very abundant, are not nearly so plentiful as in the Californian sand. I have not here counted the grains, the smallness of many of them having rendered this operation difficult. I simply estimated them by sight, separating from them as much as possible, under the microscope, the grains of a different nature. According to this estimation they were composed of:—

Magnetic oxide of iron obtained exactly..	34.35
Titaniferous oxide of iron and specular iron.....	15.00
Zircon	20.00
Quartz	25.00
Coridon	1.00
Rock of a greyish yellow, opaque, probably quartz, iron pyrites, and gold..	4.65
	100.00

Among the crystals of titaniferous oxide of iron and specular iron, a certain number have preserved easily appreciable forms. They have, in general, much lustre: the crystals of zircon, for the most part very clear, are frequently terminated at their two extremities; they possess the red-orange colour proper to that mineral. These crystals are longer than those of California; their forms, although the same, differ, however, essentially in the difference of the extension of the faces. These are four-sided prisms, h', surmounted by a long dioctohedron, and terminated by very short facettes, a'. They are perceived only in the projection of the crystals by an obtuse point which terminates them.

The quartz, almost always fragmentary, is little rounded; some crystals are even observed in it terminated at their two extremities.

It may be said in general that the auriferous sand of New Granada is less rounded than that of California, from which it may be presumed that it comes from a less distance. In fact, in comparing the distance of the Andes from the Valley of Rio Dulce, we find it to be only 80 kilometres (about 50 miles), whilst we have seen that the Valley of the Sacramento was nearly 400 kilometres (about 250 miles) long. The sands of New Granada are less rich in oxide of iron than those of California, which might be owing to their washing not having been pushed quite so far; these are the only differences which have been observed; their composition is, on the contrary, identical. From this it may be concluded that the mountains which have produced them by their denudation are of the same nature, and that the Andes, for a length of more than 4,800 kilometres, present a complete identity. The regularity of this chain, which forms everywhere the barrier of the great ocean, naturally gave this idea. But the proof of the material fact is not the less interesting, and the study of the sand shows us their identity, even in all the details, which geology is not always in a condition to observe, for the minerals which they contain are disseminated in an inappreciable manner in the rock, whilst the diluvial phenomena which have at once isolated them from the rock, and concentrated in the earth, offer an easy means of studying them.

[*To be continued.*]

REPORT OF THE COMMISSIONER OF PATENTS OF THE UNITED STATES ON EXPLOSIONS OF STEAM-BOILERS, DECEMBER 30, 1848.

The returns received enumerate 233 explosions of steam-boat boilers, from which accidents the number killed (as given in 164 cases) is 1,805; making an average of 11 for each accident. If the 69 cases in which the number killed is not stated average the same, the total loss of life, in the 233 cases, would amount to 2,563.

The number wounded, in 111 cases, is 1,015—an average of 9. The same calculation as in the former case would give as the total number wounded, 2,097; making the whole number of sufferers 4,660.

The amount of pecuniary loss sustained in 75 cases is 997,650 dollars—giving an average loss of 13,302 dollars by each explosion; which, applied to the whole number of cases, would make the entire loss 3,099,366 dollars.

Of the explosions enumerated, 202, or .867 per cent., occurred on the southern and western waters; 146, or .626 per cent., on the Mississippi river and its tributaries; 90, or .386 per cent., on the Mississippi alone; 40, or .172 per cent., on the Ohio.

From 1830 to the present time the number of explosions given is 198; making an average of 10 each year, with 110 as the average annual loss of life, and 90 the annual average of wounded; the total number of sufferers, annually, being 200; and the annual pecuniary loss 133,020 dollars.

The steam-boat tonnage of the western rivers in 1846 was 249,055; and the whole value of the commerce of these boats 62,206,719 rix-dollars. The probable extent in miles of the steam navigation of the western waters, as estimated by Colonel Long, of the topographical engineers, is 16,674.* The whole number of steam-vessels built in the United States from 1830 to 1847, inclusive, is 1,915.† The losses by explosion during the same period amount, according to the returns furnished, to 198, or about 10 per cent.

There is something in the appalling nature of steam-boiler explosions which strikes public attention, and has given rise to an impression that steam-boats and railroads are more dangerous modes of conveyance than any others. It is to be regretted that no direct means of making a comparison through a series of years between the losses by ordinary navigation and those by steam navigation are in the possession of the office.

To make a comparison which should be perfectly fair it would be necessary to take an equal number of steamers and other vessels having the same route, and exposed in common to the same sources of danger, except those arising from the employment of steam as the motive power. It would be very difficult to obtain the means of doing this. But a general and somewhat loose comparison can be made, which may serve to correct a false impression which undeniably exists with regard to the comparative safety of the two modes of travel. It appears from a statement contained in a memorial addressed to Congress on this subject that in the year 1839 the number of American vessels lost by ordinary navigation was 1,059, and that in the month of December alone of that year 181 vessels and 179 lives were destroyed.‡ Thus the number of lives lost in that month is nearly double the average annual loss of life by steam-boat explosions, as deduced from the foregoing calculations. A comparison of the number of vessels exposed would not give a fair estimate of the relative danger of the two modes of transportation, because the number of individuals exposed to the dangers from steam transportation is vastly greater in proportion to the number of vessels than those exposed in ordinary navigation.

In speaking thus favourably of the comparative safety of steam navigation, it is not intended to assert that steam has not added, in each individual case, a new element of danger to the means of transportation where it is employed. But, in endeavouring to estimate the absolute risk in each kind of navigation, we must take into the account every source of danger to which each is subject, and, so doing, we find the risk from ordinary navigation to exceed that from navigation by steam. In the case of the former, disasters frequently occur in a distant quarter, in the presence of comparatively few witnesses, and many of them are never noticed by the press. They are regarded as matters of course, the results of natural causes, over which man has no control. In the latter, on the contrary, every circumstance is present which would tend to exaggerate the impression upon the public mind. It is merely for the purpose of removing an injurious misconception that the comparison just given, which does not pretend to accuracy, has been made.

For the five years ending with 1828, the ratio of explosions to the number of exposures on steam-boat routes from New York city was 1 to 126,211. In the next five years, ending with 1833, the ratio was reduced so as to show 1 to 151,931; and in the next five years it fell to 1 to 1,985,787.*

The result of a similar calculation with reference to western navigation is less favourable. In the memorial of a "Committee on Abuses of Steam Navigation at Cincinnati," laid before Congress at its last session, the number of lives annually exposed to the dangers of steam navigation is estimated at 8,185,000. Taking the average annual loss of life on these waters at 70,† we find its ratio to the whole number of lives exposed to be 1 to 102,642, and the ratio of explosions to the number of exposures to be 1 to 560,616.

From these facts it appears that the dangers of steam navigation on the western waters, though obviously greater than those at the east, still bear a favourable comparison with those of other modes of water conveyance. Yet so much terror has been excited in the public mind by accidents of this kind that the prevention of them has (and, no doubt, properly) been considered by those nations which have made most use of the powerful and useful, though dangerous agency, of steam as calling for special legislative interference. As early as 1817‡ a committee of the British Parliament was charged with the investigation of the causes of explosions, and much valuable information was elicited by the examination of engineers and others which they instituted. That committee felt and acknowledged the inexpediency of "legislative interference with the management of private concerns or property, further than the public safety should demand;" but they urged "that a consideration of what is due to public safety has on several occasions established the principle that where that safety may be endangered by ignorance, avarice, or inattention, against which individuals are unable, either from the want of knowledge, or of the power, to protect themselves, it becomes the duty of Parliament to interfere." This principle has been acknowledged also by the French Government and by our own. Of the propriety and necessity for legislation of some kind there can be no doubt; the only question is, as to what the character of that legislation ought to be. The determination of this question involves the consideration of the causes of these fatal occurrences, and the remedies which have been proposed.

The fact that the steam-engine has come into such general use, and has been placed under the management of men widely differing in their education and judgment, and many of them entirely destitute of scientific knowledge, has given rise to a great variety of hypothesis designed to account for the explosions of steam-boilers. Most of them have been mere crude speculations, without any foundation in fact or in physical analogy. Such are the pretended explanations which refer the explosion to the presence of electricity or the generation of hydrogen gas, and its union in explosive proportion with oxygen within the boiler. Of the former hypothesis, it is only necessary to say, that electricity, if present at all, would reside on the outside of the

* American Almanac, 1849.

† Rep. Sec. Treas. Dec. 1847. Sen. Doc. No. 5, 30th Cong., 1st Sess., p. 396.

‡ Sen. Doc. 309, 1st session, 26th Congress.

* Redfield's Replies to British Commissioners, Sen. Doc. 309, 1st sessions, 26th Congress.

† Calculated by the per centage.

‡ British Parliamentary Reports, 1817, vol. iv.

boiler; and of the latter, that the necessary conditions are not present which would render it probable. In the ordinary condition of a boiler no hydrogen is produced; and if it were present it could not procure a sufficient supply of oxygen to combine with it in explosive proportion.*

Another hypothesis accounts for the explosion in this way :—The water falling below the fire line in the boiler, the portion of the latter thus exposed becomes excessively heated, and communicates its heat to the steam, which thus becomes surcharged with heat. Now, steam, when heated separately from the water which generates it, follows the law which regulates the expansion of ordinary gases, *i.e.*, it expands $\frac{1}{480}$th part of its bulk (or nearly) for every degree of Fahrenheit above the freezing point. The increase of elastic force is, therefore, under these circumstances, very small in proportion to the increase of temperature. But, while the steam is thus surcharged, a supply of water is sent into the boiler, the surcharged steam at once becomes converted into saturated steam of high elastic power, and an explosion follows. This hypothesis, although ingenious, and long received as the true explanation of the phenomenon, is found to be contradicted by the results of careful and repeated experiments. The committee of the Franklin Institute,† "appointed to examine into the causes of the explosions of the boilers used on board of steam-boats, and to devise the most effectual means of preventing the accidents, or of diminishing the extent of their injurious effects," to whose valuable labours, which have thrown great light upon this whole subject, frequent reference will be made in this report, made a series of experiments in the prosecution of one point of their inquiries, to "acertain whether intensely heated and unsaturated steam can, by the projection of water into it, produce highly elastic vapour," and satisfied themselves that in no case was an increase of elasticity produced by injecting water into hot and unsaturated steam, but the reverse; and, in general, that the greater quantity thus introduced, the more considerable was the diminution in the elasticity of the steam.‡

A fourth hypothesis has been advanced in a communication to this office, from Mr. N. Sawyer, mechanical engineer, of Baltimore, which may perhaps deserve the test of experiment. It supposes the water in a steam-boiler to be permanently thrown out of level by the unequal pressure on its surface, resulting from the escape of the steam through the throttle-valve, and at one end, and the consequent diminution of pressure at that point. This alteration of level, of course, exposes a portion of the boiler to become unduly heated, and, when the working of the engine is stopped, the restoration of level by gravity brings a quantity of water in contact with the overheated metal, producing highly elastic steam, which, according to the author, may result in an explosion. The existence of the difference of level here supposed is supported by the testimony of Mr. C. Evans, who remarks, in an article on the causes of explosion, that "wherever the steam is taken from to supply the engine there will be the greatest ebullition, and the water will be higher there than in any other part of the boiler."* The Franklin Committee, in their experiments to ascertain "whether, on relieving water heated to or above the boiling point from pressure, any commotion is produced in the fluid," found that, "on making on opening in the boiler, even when the pressure did not exceed two atmospheres, a local foaming commenced at the point of escape, followed soon by a general foaming throughout the boiler, more violent in proportion as the opening was increased."† Though the difference of level thus produced could not, it is believed, be sufficient to account for the production of a quantity of steam great enough to result in an explosion, yet the extent to which it would operate could be determined only by experiment.

A hypothesis which has been lately advanced, and to which the attention of Congress has been asked, in a published letter from its author, addressed to the Hon. John Davis, of the Senate, would not have been noticed here but for the latter circumstance. This explanation of explosion, so far as it can be gathered from the pamphlet in which it is set forth,‡ attributes the phenomena to the action of liberated caloric, set free by relieving the pressure under which its combination with water is stated to be alone possible. This hypothesis seems to have been suggested by the supposed impossibility of accounting for the phenomena of explosion from the gradually-increased elasticity of steam by heat. That a gradual increase of pressure can produce all the effects of the most violent explosions has been conclusively proved by the experiments of the committee of the Franklin Institute; in which it was shown that the very effects which, in the pamphlet alluded to, are considered impossible to arise from such a cause did actually follow the gradually-increased tension of the steam.§ The existence of one sufficient cause, fully supported by the experiments of men so distinguished for scientific ability as were the members of that commttee, renders unnecessary a resort to vague hypotheses, unfortified by facts, having no foundation in physical analogy, and, as in the present case, based upon an assumption in contradiction of a well-known physical law. Such hypotheses can only serve to divert the minds of practical men from the true causes of these fatal disasters, and thus still farther to embarrass the question of their proper remedy.

The question of the causes of steam-boiler explosions, if ever solved, is to find its solution in the researches of men of true science, conducted by the order of the Government, and at its expense. The experiments necessary to its full elucidation require too heavy an outlay to be within the reach of the means of private individuals, or even institutions; and the nature of the interests to be protected have made them, by the acknowledgment of all, a proper object of public appropriation. The most valuable contributions to our knowledge of the causes of explosions have been made by the scientific labours of the committee of the Franklin Institute, undertaken at the request and prosecuted at the expense, so far as the apparatus was concerned, of the Treasury Department, in 1831. The services of the committee were gratuitous, although rendered at the expense of much time and labour; and the chairman, Dr. A. D. Bache, the present superintendent of the coast survey, devoted the greater part of his leisure during four years to the investigation. Previous to commencing the experiments, the committee addressed a circular to every engineer known to them as connected with the practical application of steam, and who had any personal knowledge of the explosion of a boiler. The answers to these circulars, though containing many crude hypotheses, furnished a valuable collection of facts and suggestions which served to guide the researches of the committee.* The undersigned cannot but believe that the institution of a new series of experiments on the same subject, conducted in the same spirit, and on the same liberal scale as those of the committee alluded to, would serve to confirm the knowledge already acquired, and throw still further light upon this interesting and important inquiry.

The causes of explosion, as laid down by the committee, are:—

1. Excessive pressure within a boiler, the pressure being gradually increased.
2. The presence of unduly-heated metal within a boiler.
3. Defects in the construction of a boiler or its appendages.
4. The carelessness or ignorance of those entrusted with the management of the steam-engine.†

The causes, so far as they are stated in the returns to this office, may all be included under one or other of these classes.

How far these causes are correctly assigned the undersigned is not able to say, as the means by which they were ascertained are not known to this office. It is desirable that, in case of future explosions, provision should be made for obtaining full and accurate information of the nature and causes of the accident. Entire reliance cannot be placed on the testimony of ordinary eyewitnesses, however honest their intentions; and still less confidence can be reposed in that of the engineers and officers of the boat on which the accident occurs, as they are directly interested in showing that it was the result of no dereliction of duty on their part. But, improper influences aside, persons unacquainted with the nature and properties of steam and the steam-engine are not competent to form an opinion of any value upon the causes of an explosion. Nor are those who have a merely practical knowledge of these matters in a better situation for this purpose. They have too often preconceived opinions or hypotheses to which they are anxious to make facts agree, and, without intention to deceive, they are apt to seize upon those facts which seem to justify their prejudices, and disregard others of a different tendency. It is to an investigation by scientific men alone,—men who value hypotheses only as they are in accordance with, and serve to account for, facts, and who are ready to abandon them whenever and as often as they are found to conflict with well-ascertained facts,—that we are to look for a satisfactory determination of the causes of these disasters. It might be made the duty of the inspectors of steam-boilers to keep an accurate record of the explosions which occur in their several districts; they might be authorized to procure an examination in every such case by persons having the necessary scientific qualifications, and required to report at stated periods to an appropriate bureau at Washington. The collating and comparing of the information thus furnished would, doubtless, lead to valuable deductions, and have an important bearing upon future legislation with reference to this subject. In a great majority of the cases embraced in the accompanying table it is known that no scientific investigation was had, and the returns, so far as the question of causes is concerned, are probably, therefore, based upon common report, or the mere opinions of engineers.

That "undue pressure within a boiler gradually increased" is one of the most frequent causes of explosions has been proved, as well by recorded cases as by the experiments of the committee. One of the points of inquiry to which

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* The production of hydrogen was referred to the decomposition of water by the heated metal. The conclusions drawn by the Franklin Institute Committee, from their experiments to determine "whether any permanently elastic fluids are produced within a boiler when the metal becomes intensely heated," are, "1. That the gas obtained by injecting water upon the bottom of a boiler which was at a bright red heat was nitrogen gas with a variable quantity of oxygen; it was, in fact, atmospheric air, deprived by the heated metal of more or less of its oxygen. 2. That this air was derived principally from the current into the boiler, when surcharged steam had ceased to be formed, and the boiler was left dry; there will therefore be no such quantity in a working boiler where the air must be supplied from the cold water thrown in. 3. That water in contact with heated iron in a steam-boiler, the surface being in its ordinary state, clean, not bright, is not decomposed by heat."—*Frank. Jour.*, vol. xvii., p. 222.

† Dr. A. D. Bache was the chairman of this committee.

‡ "Journ. Frank. Inst.," vol. xvii., p. 19.

* *Pittsburgh Morning Chronicle*, March 2, 1848.

† "Frank. Jour.," vol. xvii., p. 8.

‡ Pamphlet on "The Causes and Effects of Explosions in Steam Engines," &c., by John Wilder, New York, 1847.

§ "Rep. on Experiments," p. 68.

* "Encyc. Amer.," vol. xiv., p. 652.

† "General Report on Explosion," p. 6.

their attention was specially directed was to ascertain the sort of bursting produced by a gradual increase of pressure; and after several decisive experiments they came to the conclusion that all the circumstances attending the most violent explosions may occur without a sudden increase of pressure within a boiler.* This gradually-increased pressure may result from the accidental failure of the apparatus intended to relieve it, or from this being intentionally prevented from operating by the reckless hands which sometimes have the control of it. Of the ninety-eight cases in which the causes of explosions are stated in the returns herewith submitted, sixteen (being $16\frac{1}{3}$ per cent. of the whole) are assigned to this cause. The term "excessive pressure" in the table indicates these cases.

The cases referred to "the presence of unduly-heated metal within the boiler" are also sixteen. The danger attending the overheating of the boiler arises from the diminished tenacity of the metal thereby produced, which renders it incapable of any longer sustaining the ordinary working pressure; and from the metal being made itself a reservoir of heat, capable of generating an increased quantity of highly elastic steam, as soon as water shall be brought in contact with it. This overheating of the boiler may be occasioned by suffering the water to become too low, or by allowing sediment to accumulate on the bottom. The former cause operates by exposing a portion of the surface next the fire to the action of heat while uncovered by water, and the latter by interposing a medium of but low conducting power between the fire and the water, thereby suffering the metal to acquire heat faster than that heat can be conveyed to the water. In either case the metal is technically said to be "burnt," and, even if no serious consequences should occur at the time when such burning takes place, still the tenacity of the metal is thereby permanently diminished, its thickness decreased,† and the liability to explosion, therefore, greatly enhanced. In boilers where flues are employed, their collapse is the ordinary result of this state of things.

The deficiency of water may be the consequence of the pumps being obstructed, so as to throw in less than the requisite supply; or from their being heated, so as to inject steam; or from their not being in action when the engine is stopped and steam blowing off. The sudden removal of these causes of deficient supply, while the intensity of the fire continues at the same time undiminished, is very likely to produce an explosion for reasons already explained. Hence the greater number of these accidents which occur immediately upon starting the engine after a stopping at a landing or for repairs. Mr. Evans expresses the opinion that "eight out of ten explosions take place just at the time of starting from a landing, the engine making generally but one or two revolutions."‡

The subject of deposits, in connection with the overheating of the metal of the boiler, is one of great importance, and one which is still comparatively open as a field of research. The Franklin Committee made it one point of their inquiry to ascertain by experiment the effect of deposits in boilers. They admitted the collection and hardening of such deposits on the bottom of the boiler, and attributed the danger from them to the production of exfoliations of oxide, which gradually reduced the thickness of the metal, or to the weakening increase of temperature in the metal which they permit.§

With regard to incrustations and deposites in the interior of steam-boilers, it may in general be admitted that these must differ with the character of the water used. In boilers using "hard" water they consist chiefly of the carbonates of lime and iron mixed with oxide of iron; containing, besides, the earthy salts from the water. Boilers using ocean water are found to detect the differences existing in different parts of the ocean in regard to the composition of its water. It appears that certain "scales" which were taken from the boilers of the United States steamer Marcy, and subjected to analysis by Professor Johnson, were found to collect in the boilers while running over the Bahama Banks; and the experience of the Marcy is confirmed by that of other steamers which have traversed the same tract of the Atlantic. Professor Johnson's analysis showed this salt to be dihydrated gypsum, and led him to the application of the acetate of potassa as a solvent.*

The introduction of oil or fat into a boiler may result in the production of another class of deposites entirely different from the scales above alluded to, and which appear to result from a combination of fatty materials with earthy bases. Such an incrustation was found in the interior of a steam-boiler at Burlington, N.J., and was submitted to examination by Professor Johnson, who supposes it to be a species of soap, formed between the earthy oxides and the acids of animal fat.†

In streams which, like the Mississippi and its tributaries, flow for thousands of miles through an alluvial country, and which are subject to freshets, not unfrequently producing alterations in depth of from thirty to fifty feet, the quantity of earthy, calcareous, and other matters held in suspension is great, almost beyond conception. Mr. Cist gives the estimate of an intelligent engineer, that, in a twelve days' trip on the Mississippi, the quantity of mud injected into the boilers was 51,600 gallons by measurement, or over 200 tons in weight. This calculation is based upon the supposition that the sediment in the water amounted to 10 per cent., a rate said to be below the fact, at least as regards the Mississippi.. This sediment collecting on the bottom of a boiler becomes, owing to the admixture of calcareous matter with the mud of which it is chiefly composed, hardened by heat to such a degree that very often it can be removed only by the use of a chisel and mallet. Thus hardened, it is liable to crack from unequal expansion or other cause, when it admits water to come in contact with the overheated and softened metal below. The necessity for constant attention to the condition of the boilers with reference to this matter is sufficiently obvious. The deposites from salt and chalybeate waters are not less dangerous.

The causes of unduly-heated metal within a boiler usually operating are, no doubt, those which have just been described; yet the Franklin Committee were induced, from the evidence before them, to admit the possibility of the metal of a boiler becoming unduly heated, even when in contact with water: the occurrence of such a fact, however, is extremely rare.

About one third of the cases reported in the returns are attributed to "defective construction of the boiler and its appendages." These defects may be reduced to three classes:—1. Defects in the form of the boiler. 2. The use of improper or defective material. 3. Bad workmanship. The first class is not noticed as a cause of explosion in the returns to this office. In the second are embraced fifteen cases; in the last, eight. In eleven others, the particular nature of the defect is not stated.

That the influence of form upon the strength of a boiler must be very great is obvious. The forms most commonly employed are, the wagon boiler of Watt, and the cylindrical boiler, either with or without flues. The boiler of Watt is only adapted to very low steam. Of cylindrical boilers, those without flues are most safe—those with flues have the advantage of economizing fuel. Those flues which pass through both heads of the boiler are considered the most safe. Boilers containing small tubes have not been found successful.

The connected boilers which are used on our western boats are incident to a peculiar source of danger; a mere change of position may be the cause of an explosion. The connecting water-pipe is at the bottom of the boilers. When the boat careens, the water descends, of course, to the lower boiler, and leaves the higher ones exposed, in a greater or less degree, to the action of the fire while uncovered by water. The danger from such an exposure has already been pointed out. The use of connected boilers, in the opinion of the Franklin Committee, ought to be discontinued.

[*To be continued.*]

* "Frank Jour.," vol. xvii., p. 225.

† The diminution of tenacity from overheating was found by the sub-committee on the strength of materials to be equal to about one third of the original strength.

‡ Article in *Pittsburgh Chronicle*, before referred to.

§ "Frank. Jour.," vol. xvii., p. 233.

* "Frank. Jour.," vol. xliv., p. 226 (Oct., 1847.)

† Ibid, vol, xliv., p. 398.

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THE CHEMICAL TIMES.

SATURDAY, OCTOBER 6, 1849.

APPROACHING DISSOLUTION OF THE SEWERS COMMISSION.

We learn with considerable satisfaction that the Metropolitan Commission of Sewers will speedily be relieved from duties for the due and proper performance of which it has shown itself altogether unfit, and that the high and most important task of devising a *practicable* and *efficient* system of drainage and sewerage for the metropolis will be entrusted to an entirely new staff of functionaries.

It is, indeed, high time that the present commission should be superseded in its functions by a body of truly competent men, who will set to the work in earnest, and not squander away the public time in wrangling and personal squabbles, and the public money in sterile or dangerous experiments, such as the one, for instance, ventured upon by the present commission last Saturday in Friar-street, Borough, where it was attempted to exhaust a large sewer of the poisonous gases accumulated in it, by connecting it by means of a pipe with the ash-pit under the furnace of a steam-boiler—an experiment which, as might easily have been foreseen, ended in a terrific explosion, *most fortunately* unattended with fatal consequences. In this case the commissioners had had the almost incredible hardihood to assure the proprietors of the steam-boiler that there could be no risk of an explosion of inflammable gases, *as certified to them by their consulting chemist, Mr. Cooper!*

We sincerely hope and trust that the Government will have profited from the experience of the last two years, and that the new board will be constituted very differently from the present one. Above all, we hope that the new commissioners will be composed entirely of scientific and practical men, and that there will be in future no intermeddling on the part of noble or clerical *dilettanti*.

We think that the lamentable failure of the

present commission is in a measure attributable to its excessive numbers. We know it is generally held that there is safety in a multitude of counsellors. However so true and applicable this adage may be in general, the experience which we have had of the Commission of Sewers has tended rather to prove the truth of the opposite saying, viz., that "too many cooks spoil the broth." We hope, therefore, that the numbers of the new board will be restricted within reasonable limits.

A properly constituted board of thoroughly competent practical men will achieve more good for the health of the metropolis in two months than the present commission has even *attempted* to effect in two years.

PROCEEDINGS OF LEARNED SOCIETIES.

PHARMACEUTICAL MEETING, LIVERPOOL. ROYAL INSTITUTION.

Friday Evening, August 31, 1849.—The Secretary in the chair. Dr. Brett gave his first lecture on toxicology, of which the following is a short abstract :—

The term poison requires some definition, and the popular acceptation of it is hardly a proper one; it is not correct, for example, to suppose that those substances only are poisons that are capable of destroying life when taken in minute quantity, for oxalic acid is a poison, and yet the smallest quantity ever known to produce death is half an ounce! Others, on the contrary, only act fatally in small quantity, as sulphate of zinc, which is thrown entirely off the stomach, if taken in large doses, while a small quantity would be absorbed, and produce death. Arsenic is poisonous in minute doses; one grain of it has been known to produce death; and even when larger quantities are taken it is that small portion only which becomes absorbed by the system that acts fatally. Neither is it necessary for a poison to be taken internally; arsenic has frequently destroyed life by being applied as a plaster, and many instances of external poisoning might be named. The definition of the term poison must therefore be a very general one, viz., a substance capable of destroying life in either small or large doses, independent of any idiosyncratic, pre-abnormal, or morbid condition of the system, and independent of mechanical irritation or abrasion. Iron nails, or needles, for instance, could hardly be classed as poisons, though fatal if swallowed.

The classification of poisons is very important, and often leads at once to a judgment on the character of the poison, and indicates its antidote.

They are divided into four classes :—The irritant; corrosive; narcotic; acrid narcotic.

The first produce irritation, then inflammation, a determination of blood to the part poisoned, a quickened circulation, and absorption of the poison.

The second act locally, destroying, perforating, softening, and dissolving the organic tissues with which they come in contact, and, irrespective of the vital functions, actually destroy the organs of life.

The third class neither corrode, inflame, nor irritate, but act on the nervous system alone, depressing the nerves, and through them paralyzing the spinal marrow and brain.

The last resemble the narcotics in the *modus operandi* of their action, and produce death in the same way, but still produce also symptoms analogous to the first class, irritating and inflaming the stomach and bowels.

The action of a poison may be either local or remote. Sir B. Brodie found that leaves of the Aconitum napellus, when chewed, deprived the lips of sensation for some hours; and Robiquet inverted a test-tube containing prussic acid upon the end of his finger, and found it devoid of sensation for a still longer period. But it is the remote action of poisons to which our attention is chiefly called, and this may operate in two ways :—

1st. By nervous sympathy.

2d. By absorption.

Each of these actions have been propounded as the only way in which poisons act; and Morgan and Addison carried out many valuable experiments in support of their adopted theories, until they at last came to the conclusion that no such rule would apply to all poisons, and that truth rested with each.

On one occasion they caused the jugular vein of a dog to pass into that of another dog, so that the blood from each flowed into the other, and completely connected the veinous systems. One dog was then poisoned with the urari poison, and died instantly; while the other dog remained alive and unaffected, proving that the poison was not absorbed by the blood, but acted upon the brain by the nerves.

On the other hand, prussiate of potash has been detected in the blood in less than two minutes after administration; and Christison mentions that four ounces of solution of oxalic acid was thrown into the peritoneal sac of a cat, which caused death in fifteen minutes; and upon opening immediately after only one drachm of the liquid was found in the sac, proving the rapidity of its absorption.

With regard to the chemical theory suggested by Liebig, Dr. Brett considers nothing more fallacious and unsubstantiated; the supposition that every poison, whether dilute or concentrate, potent or gradual, acts by chemical combination with organic tissue, he deems absurd; and he cannot readily conceive of an experienced physiologist entertaining such views in spite of the frequent evidence of the fatal action of a poison, when, on opening after death, no indication of irritation, inflammation, or any other trace of chemical action can be found.

Antidotes are of two characters: first, physiological, to counteract the effect upon the system; and second, chemical, combining directly with the poison to produce insoluble or inert salts, as magnesia for sulphuric acid, lime for oxalic, &c., albumen for corrosive sublimate, sugar for copper, tannin for tartar emetic, &c.

Dr. Brett then illustrated his subject with several interesting cases in which he had been engaged, and concluded a very instructive and interesting lecture by pointing out the extreme caution necessary in medico and chemico-legal questions, the check which should be put upon conjecture, and the importance of allowing the judgment to be influenced only by the actual and ample evidence obtained.

Mr. Abraham inquired if animal charcoal had not been successfully used as an antidote to arsenic and other poisons?

Dr. Brett did not think it of much value. It had been administered with the poison to some rabbits, but they died. If of any use, he thought it must be in a large quantity, and act mechanically by protecting the coats of the stomach from absorbing the poison. Arsenic was absorbed very rapidly. He had known death ensue very shortly from the application of an arsenical plaster on the arm, and the stomach and intestines were much inflamed.

Mr. Waldie remarked that charcoal had great power in withdrawing substances from solution, as lead from its diacetate, also bitter matter from organic solutions. A considerable portion of morphia is found to be lost when animal charcoal is used; and charcoal he thought might, on this account, be useful in organic poisonings. The hydrated oxide of iron he thought useless unless fresh prepared, as it became less soluble in acids by keeping, and long boiling rendered it very insoluble.

Dr. Brett said the French had used the native oxide of iron with reputed success; but the insoluble salt of arsenic thus formed was readily decomposed by hydrochloric acid, and he doubted whether a sufficient quantity might not exist in the secretions to render it still dangerous.

Mr. Edwards said he believed bichloride of mercury was slightly soluble in a large excess of albumen, and that the value of the latter as an antidote was therefore impaired.

THE HEALTH OF LONDON DURING THE WEEK.

[From the Registrar-General's Report.]

It is gratifying to observe the further abatement of pestilence in London. After the first week of September, in which the fatality from cholera was greatest, and 3,183 persons died from all causes, the total number fell in the second week to 2,865, then to 1,981, and in the week ending last Saturday the total deaths registered were 1,611. During the same period the weekly numbers of lives destroyed by cholera have been 2,026, 1,682, 839, and in the last week 434. Diarrhœa was fatal successively to 272, 280, 238, and last week to 163. In comparing the returns for the last two weeks, the decline of mortality is most obvious in the south districts, where the deaths from cholera have fallen from 422 in the week ending September 22 to 161 in the last; and, to take the most striking examples of particular districts, in St. George's, Southwark, they declined from 58 to 10, in Newington from 66 to 15, and in Lambeth from 117 to 50. In the north and central districts the improvement is also remarkable, in the former the deaths from cholera in the two weeks having been, consecutively, 71 and 37, and in the central having been 95 and 51. The improvement in the east districts is not so great, the 183 deaths of the previous week having fallen to 113 in the last; but in the west districts the public health has recently been stationary, the weekly deaths caused by the epidemic having been 68 and 72, though here, too, a great change has taken place for the better in the latter half of September as compared with the former. In the whole metropolis the daily number of deaths from cholera last week has fluctuated between 102 and 53, but showing an almost constant tendency to fall. The mortality from smallpox, measles, and scarlatina is much less than the average; from whooping cough it is near the average; typhus has recently shown a slight increase.

The mean height of the barometer in the week was 29.680. The highest temperature occurred on Tuesday, when it was 72.7; the highest mean temperature on Thursday, when it was 62.2. The mean temperature of the week was 58.4, and was higher than the average of the same week in seven years by 5.4.

Variety and Vividness of Colours in Flowers.—The petals of flowers do not owe their beauty to the colour that paints them, for that when drawn off is dull and dead; neither do they owe their brilliant tints to the skin that covers them. Their lovely appearance is derived chiefly from the bubbles of water which compose their pabulum. Receiving the sun's rays, they are enlivened and brightened by reflection and refraction from those drops of water, and from that spot or point of light being seen in every bubble, and striking to the focus underneath. By these means the whole flower would at times be one blaze of light, had not nature, to soften the same, covered the petal with an upper and under skin which curtails their diamond-like rays, and leaves them instead a lightness and beauty unequalled by the most exquisite art of the painter.

Charles Vignoles, of Trafalgar-square, in the county of Middlesex, civil engineer, for an improved method of preparing or manufacturing peat or turf for fuel. Sealed September 10th, 1849; six months.—(Communication.)

George Fergusson Wilson, of Belmont, Vauxhall, for improvements in separating the more liquid parts from the more solid parts of fatty and oily matters; and in separating fatty and oily matters; and in the manufacture of candles and night lights. Sealed September 12th, 1849; six months.

STATEMENT IN CONTINUATION OF THE ONE PUBLISHED IN THE CHEMICAL TIMES OF SEPT. 29, 1849, SHOWING THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE AIR FROM SEPT. 23 TO SEPT. 29 INCLUSIVE, AS INDICATED BY THE EVAPORATION OF WATER FROM TWO COPPER VESSELS OR SCALES, ONE INSULATED AND THE OTHER NOT. ALSO THE READING OF THE BAROMETER, THERMOMETER, DIRECTION OF WIND, AND GENERAL STATE OF THE WEATHER.

Sept., 1849.	Barometer.		Therm.		Scales.				Wind.		General state of weather.
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Insulated	Non-Insulated	Morning.	Evening.	
23	29.92	29.92	60	59	10 N.	..	..	10	SE.	SW.	Generally rain all day; fine evening.
24	29.85	29.85	59	59	..	10 N.	..	10	S.	SE.	Fine all day; evaporation very sluggish.
25	29.85	29.85	58	57	..	5 N.	..	5	SE.	E.	Fine all day, but a dense fog to the east at 10 A.M.; evaporation sluggish.
26	29.84	29.81	58	60	10 N.	5 N.	..	15	SE.	SE.	Fine all day; evaporation sluggish.
27	29.77	29.79	63	65	..	..	..	..	SE.	E.	Fine all day; overcast at night.
28	29.83	29.79	59	61	..	..	..	..	SW.	SW.	Heavy rain from 12 to 6 A.M.; fine rest of the day; rain in the evening.
29	29.70	29.45	62	61	..	..	..	..	S.	SW.	Rain at 6 A.M.; showers during the day, and heavy rain at night.

By the figures afforded last week and this the scales and the cholera appear no longer disposed to keep company, and what is most incomprehensible is that the cholera is on the decline under atmospheric conditions almost similar to those under which it raged with the greatest virulence. May not the season of the year have some influence?

Westminster-road, Oct. 2, 1849.

Franklin Coxworthy, Author of "Electrical Condition," &c.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

John Mackintosh, Bedford-square, for improvements in furnaces and machinery for obtaining power, and in regulating, measuring, and registering the flow of fluids and liquids. Patent dated March 24, 1849. Enrolled September 24, 1849.

1. The improvements in "furnaces" consist in preventing the external air from passing to the fuel through the door and ash-pit, and in supplying it by any suitable blowing machine through a small orifice cut for that purpose. The "expanded air" and products of combustion are thereby driven into a close chamber, fitted to the opposite end of the boiler, whence they escape, and are applied to the working of an engine, while the steam is applied to work a second engine.

The employment of this invention in steam-vessels will, it is stated, render the use of chimneys unnecessary, as the air and products of combustion may be allowed to escape after the work is done through openings cut in the side of the vessel near the line of floatation.

2. "For obtaining power," Mr. Mackintosh proposes to place a cistern, partially filled with water, in the lower and central portion of a ship. A steam-chest is placed in the cistern, and has two or more "trunks" connected to it, each divided into two equal portions by a flexible partition attached to the top and bottom of the two ends. The trunks are inclined, or curved, so that their free ends may be partially above the level of the water, and the attached ones entirely beneath it. When the apparatus is not in action the water flows into the lower divisions of the trunks and raises the flexible partitions to a level with it, but on steam being admitted to the trunk alternately from the steam-chest, by means of valves constructed as described in a former specification, the water will be forcibly expelled, and the vessel, it is stated, be thereby propelled. The water re-enters the trunks through valves placed behind the partitions. Or,

3. A series of horizontal tubes are placed in the interior of the vessel, each having the one end connected to a steam-chest, and the other opening into the surrounding water beneath the line of floatation. The tubes are constructed with lateral openings, which are fitted on the inside with flap-valves, and admit air into the interior. Steam is then made to pass from the steam-chest by means of the peculiar kind of valves before mentioned, which will, by its pressure, cause the flap-valves to close the lateral openings and the air to be expelled into the water, whereby the vessel will be propelled. The outer ends of the tubes are contracted, and furnished with flap-valves, opening outwards, so as to prevent the inflow of water when the jet has ceased.

The patentee states that the preceding arrangements may be applied, when suitably modified, to the propulsion of carriages.

4. To prevent the recoil of a gun after firing, it is proposed to fix to its muzzle a cylinder of much larger diameter than the gun itself, and closed at one end. The explosion of the powder will have the effect of creating a partial vacuum in the closed end of the cylinder, and the unbalanced pressure of the atmosphere against its outside will tend to prevent the recoil. The top portion of the end of the cylinder is made to open outwards, for the purpose of enabling the gunner to level the gun.—[A clever conceit, but not covered by any of the words of the title.]

5. To propel gun-boats, it is proposed to adapt a cylinder to the muzzle of the gun, and to attach a cone to it. Communication is established between the cylinder and the cone. When the gun is fired with powder only, the unbalanced pressure of the atmosphere will drive the gun forwards, and consequently the boat also. The gun is to be charged with a series of cartridges connected together by fuzees, so that the explosions may be made to take place at certain regular intervals of time successively.

6. A fourth mode of "obtaining power" is as follows:—Within a cylinder fitted with an outflow pipe, which contains a valve weighted to any desired pressure, is placed a second concentric cylinder, which is keyed on a hollow axis. Two or more channels are constructed in the second cylinder, and communicate by their inner ends with the axis, while their outer ends open into the space between the outside and inside peripheries of the two cylinders. The channels are curved about their centres, and arranged in pairs, something like the letter S. Flexible partitions are placed in the channels, so that, on steam being alternately admitted into their inside divisions through the hollow axis from the steam-chest, the flexible partitions will be distended, and the fluid or vapour which was contained in the outside divisions of the channels will be driven into the outer cylinder.

7. For "regulating the flow of fluids," the patentee employs a tube, through which the fluid flows, and which contains two partitions placed at a certain distance apart, and parallel to each other. The partitions have openings cut in their centres, and a crank lever is suspended in the space between them. To one end of the lever is attached a spring valve, which slides over the outflow opening, so as to wholly or partially close it, while another valve piece is attached to the other end of the lever, and thereby suspended opposite to the inflow opening, so that the lever will be acted on by the inflow of the fluid, and will close the outflow opening in proportion to the pressure.

8. For "measuring" he uses a meter constructed of a flexible tube, closed at one end, and having a lateral opening. Above the tube is an axle, which carries three equidistant spindles, each having a conical roller free to revolve thereon. These rollers pass over the tube, and are so placed that when one rolls off the tube at one end, the succeeding one shall roll on at the other. And if the capacity of the tube between the two rollers be ascertained, the flow of fluid will be consequently measured and indicated by suitable registering apparatus actuated by the revolution of the axle.

Claims.—1. The mode of constructing furnaces in order that the steam may be applied to work one engine, and the expanded air, together with the products of combustion, to work a second one.

2. The various modes of obtaining power for propelling.

3. The arrangements for preventing the recoil of guns.

4. The methods of regulating, measuring, and registering the flow of fluids and liquids.

David Henderson, London Works, Renfrew, for improvements in the manufacture of metal castings. Patent dated March 26th, 1849. Enrolled September 26th, 1849.

These improvements relate chiefly to the moulding and casting of pipes, cylinders, and other articles of which any great number is required. The boxes or flasks in which the pipes are moulded consist of two parts, and the internal diameter is somewhat larger than the pipe to be formed, so that there may be left about two or three inches of sand between the pattern and the inner surface of the box. Where the two boxes join, they are each furnished with a lip projecting inward, leaving a space between the two lips of the same half of the box nearly the exact diameter of the pipe. The mould, which is a short piece of what is termed a half pattern, is put between the two lips, by which, together with the aid of a clamp, it is retained in its place until the sand has been rammed in between it and the back of the box. When this has been accomplished, the short piece of pattern is drawn further along the box, and another part of the sand mould completed, and so on, till the mould has been finished, when the core is put in

in the usual manner, and the casting finished by pouring the metal into the mould. When the moulds are made of dry sand or loam instead of green sand, as has just been described, the same mould may be employed for more than one casting. After the metal of the first casting has set, it is taken out of the box, and the mould, if damaged, is repaired while yet in a hot state. A fresh core is then introduced, and the casting proceeded with as before. The flasks or boxes, being made solid (instead of being composed of ribs as heretofore), are pierced with numerous small holes for the escape of the steam and gases.

The casting of pots, mouldings, ridges, &c., are proceeded with in nearly the same manner as the pipes.

Claims.—The method described of moulding and casting pipes, cylinders, ridges, and mouldings.

Alexander Parkes, Harborne, Stafford, chemist, for improvements in the deposition and manufacture of certain metals and alloys of metals, and improved mode of heating and working certain metals and alloys of metals, and in the application of the same to various useful purposes. Patent dated March 26th, 1849. Enrolled September 26th, 1849.

Mr. Parkes' improvements consist:—

1. In depositing on the surfaces of iron tubes, or any other articles of metal, copper, silver, tin, lead, and bismuth in successive layers, through the agency of electric currents. He states that he has found the articles of metal to be better protected by this system than by the old one of coating them with one metal only.

2. In forcing air or chlorine gas by means of a blowing-machine upon the surface of copper, or the alloys of copper, in the refining furnace, for the purpose of facilitating the smelting process.

3. In forcing air, by means of a blowing-machine, upon sulphuretted copper in the blast or reverberatory furnace, after the manner specified in a former patent granted to Mr. Parkes.

4. In the application, as a blowing-machine to the two preceding purposes, of the apparatus ordinarily employed to exhaust gas from retorts.

5. In combining iron, silver, and nickel for casting with phosphorus, in the proportion of from two to ten, by dropping the phosphorus into the combined metals while in a state of fusion.

6. In coating metals, or alloys of metals, with a combination of other metals, or alloys of them, which melt at a lower temperature than the former.

7. In coating rollers which have been worn down by use with the phosphuretted metal.

8. In combining with copper or its alloys molybdenum, chromium, tungsten, and manganese, which are to be used in the form of acid oxide. The metals are placed in a crucible, covered with carbon, and a small quantity of phosphorus mixed with them.

9. The patentee proposes, lastly, to manufacture printing rollers, by coating cylinders of iron or other metals with copper. A solution of copper, in cyanide of potassium, at a temperature of 150° Fah., is employed for this purpose.

Stephen White, Victoria-place, Bury New-road, Manchester, gas-engineer, for improvements in the manufacture of gases, and in the application thereof to the purposes of heating and consuming smoke; also improvements in furnaces for economizing heat, and in apparatus for the consumption of gas. Patent dated March 26th, 1849. Enrolled September 26th, 1849.

This invention relates principally to the construction and arrangement of apparatus for the production of what is termed water gas, and which was the subject of a former patent granted to Mr. White. This gas is composed of a combination of carburetted hydrogen gas with hydrogen gas and oxide of carbon gas—the result of the decomposition of water by contact with charcoal, coke, or anthracite coal, mixed with small particles of iron or lime, heated to a high temperature.

The apparatus first specified is constructed of a material capable of bearing the greatest heat that can be obtained (white red), and consists of two vertical retorts placed in an oven over a furnace. Inside each retort there is a flue which communicates at bottom with the furnace, and at top with the oven. The products of combustion ascend the flues, and pass into the oven, so that the retorts and their contents are heated both inside and outside. They are filled with small pieces of charcoal, coke, or anthracite coal, and thin plates of iron or pieces of thin iron wire, and their covers at top, by which these materials are introduced, luted, and securely fastened down, so as to render them perfectly gas-tight. Water is caused to fall into a succession of drops, or in a small stream, into syphon-pipes, which conduct it on to the top of the materials through which the gas thus generated descends to the bottom of the retorts, whence it escapes into horizontal retorts (also placed in the oven), and there meets and mingles with carburetted hydrogen gas, which is generated in the following manner:—A quantity of resin and oil, or of tar or fat, or other substance rich in carbon and olefiant oil, is melted in a vessel, fixed on the top of the oven, and allowed to flow in a liquid state into the horizontal retorts, which are each divided into two or more compartments by horizontal partitions extending nearly to the end. These compartments are filled with copper or iron chains, or pieces of wire twisted into a spiral form, so as to offer a heated and partial resistance to the passage of the gas to the hydraulic main. When pit-coal is employed instead of resin, as the hydrocarbon, it is placed in the horizontal retorts, and the employment of the other parts of this branch of the apparatus dispensed with, care being taken to allow sufficient passage for the gas resulting from the decomposition of water to mix with the bicarburetted hydrogen gas produced by the distillation of coal.

The chains are to be occasionally taken out of the horizontal retorts, for the purpose of freeing them from the carbon which may adhere to them.

The proportion of iron to coke in the vertical retorts should be as 1 : 6, and the quantity of materials in the vertical and horizontal retorts should be so regulated with regard to one another that the proportions between the volume of the gas evolved by the decomposition of water, and that of the gas resulting from the distillation of coal, may be as 4 : 6. The gas should be tested in its passage to the gasometer by a test-burner; and, if it burns with a bright smoky flame, more water should be supplied to the vertical retorts; but, if it burns with a faint blue flame, then more of the liquid hydrocarbon should be supplied to the horizontal retorts.

2. The patentee proposes to manufacture oxygen gas for illuminating purposes, by employing nitrate of soda or of potassa. Two or more detached moveable crucibles, partially filled with either of these materials, are placed in a retort, which is heated in the ordinary manner. The number of retorts employed may be varied according to the wish of the operator and the capacity of the oven. The oxygen and nitrous fumes disengaged ascend into the hydraulic main, which contains water or lime-water. The oxygen is conducted to an apparatus where it is freed from aqueous particles, and thence to the gasometer. The nitrous fumes are absorbed by the water in the main, and form nitric acid, which is drawn off as may be deemed necessary. The residue in the crucibles form carbonate of soda or potassa, according to the substance first used, which are valuable as articles of commerce; or they may be treated with nitric acid diluted with twice its volume of water, after which the water is to be evaporated. The residue will be either nitrate of soda or potassa, which may be used again.

The improvements in heating and consuming smoke consist in causing currents of the water gas, and of atmospheric air or oxygen, to meet and burn in a suitable vessel, or behind the bridge of the furnace.

Claims. — 1. The mode of combining and arranging the parts of the apparatus, and the mode of constructing the horizontal retorts with a division, or divisions, to extend the heating surface in contact with which the generation of carburetted hydrogen gas, and its combination with the hydrogen gas and oxide of carbon gas, take place.

2. The mode of manufacturing oxygen gas by exposing the materials from which it is to be obtained to heat in detached and moveable retorts, of suitable construction, heated in the ordinary manner.

3. The application of gas evolved by the decomposition of water combined with atmospheric air or oxygen to produce heat, or with atmospheric air to consume smoke, by a current of it being directed into the flues through which the smoke passes.—*Mechanics' Magazine.*

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING SEPTEMBER 27, 1849.

John Meadows, of Princes-street, Coventry-street, in the county of Middlesex, carver and gilder, for improvements in veneering. Patent dated September 27th, 1849; six months.

John Marriott Blashfield, of Millwall, Poplar, in the county of Middlesex, roman cement manufacturer, for improvements in the manufacture of manure. Patent dated September 27th, 1849; six months.

William Browne, of St. Austell, in the county of Cornwall, mine agent, and Richard Rowe Veale, of St. Columb Major, in the said county, for improvements in preparing for pulverization flint stone, china stone, ores, minerals, spas, sands, earths, and other substances. Patent dated September 27th, 1849; six months.

Nicholas Doran Maillard, of Edward-street, Portland-street, engineer, for improvements in obtaining motive power for giving motion to machinery, and in propelling vessels. Patent dated September 27th, 1849; six months.

William Boggett, of St. Martin's-lane, in the county of Middlesex, gentleman, for improvements in heating and evaporating fluids. Patent dated September 27th, 1849; six months.

William Edward Newton, of Chancery-lane, civil engineer, for improvements in the manufacture of knobs for doors, articles of furniture, or other purposes, and in connecting metallic attachments to articles made of glass or other analogous materials. Patent dated September 27th, 1849; six months.—(Communication.)

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF SCOTLAND, FROM THE 22D DAY OF AUGUST, TO THE 22D DAY OF SEPTEMBER, 1849, INCLUSIVE.

James Nasmyth, of Patricoft, near Manchester, in the county of Lancaster, engineer, for certain improvements, and the method of, and apparatus for, communicating and regulating the power for driving or working machines employed in manufacturing, dyeing, printing, and finishing textile fabrics. Sealed August 24th, 1849; six months.

Job Cutler, of Birmingham, in the county of Warwick, gentleman, for improvements in the manufacture of metallic tubes or pipes. Sealed August 28th, 1849; four months.

Henry Gilbert, of Suffolk-place, Pall-mall East, in the county of Middlesex, surgeon, for an improved mode, or improved modes, of operating in dental surgery, and improved apparatus or instruments to be used therein. Sealed August 28th, 1849; six months.

James Robinson, of Huddersfield, in the county of York, orchil and cudbear manufacturer, for improvements in preparing or manufacturing orchil and cudbear. Sealed August 29th, 1849; six months.

William Chambers Day, of Birmingham, in the county of Warwick, ironfounder and weighing

machine manufacturer, for improvements in machinery for weighing. Sealed August 29th, 1849; six months.

Robert William Thomson, of Leicester-square, esquire, in the county of Middlesex, civil engineer, for certain improvements in writing and drawing instruments. Sealed August 31st, 1849; six months.

John Holland, of Larkhall-rise, in the parish of Clapham, in the county of Surrey, gentleman, for a new mode of making steel. Sealed September 11th, 1849; four months.

Edwin Haywood, of Glusburn, in the county of York, designer to Messrs. Thomas and Matthew Bairstow, of Sutton, in the county aforesaid, for improvements in plain and ornamental weaving. Sealed September 11th, 1849; six months.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF IRELAND, FROM THE 21ST DAY OF AUGUST, TO THE 21ST DAY OF SEPTEMBER, 1849, INCLUSIVE.

Hugh Lee Pattinson, of Scots'-house, near Gateshead, in the county of Durham, chemical manufacturer, for improvements in manufacturing a certain compound or certain compounds of lead, and the application of a certain compound or certain compounds of lead to various useful purposes. Sealed August 22d, 1849; six months.

Rees Reece, of London, chemist, for improvements in treating peat, and obtaining products therefrom. Sealed August 29th, 1849; six months.

Thomas John Knowlys, of Heysham Tower, near Lancaster, esquire, for improvements in the application, removal, and compression of atmospheric air. Sealed September 10th, 1849; six months.

George Nasmyth, of Great George-street, Westminster, civil engineer, for certain improvements in the construction of fire-proof flooring and roofing, which improvements are applicable to the construction of viaducts, aqueducts, and culverts. Sealed September 18th, 1849; six months.

PATENTS RECENTLY EXPIRED.

W. Mason, Camden-town, engineer, for certain improvements in wheels, boxes, and axle-trees of carriages, for carrying persons and goods on common roads and railways. Patent dated September 24th, 1835. Expired September 24th, 1849.

J. P. Westhead, Manchester, manufacturer, for certain improvements in the manufacture of small wares; and an improved arrangement of machinery for covering or forming a case around any wire, cord, gut, thread, or other substance, so as to render the same suitable for various useful purposes. Patent dated September 24th, 1835. Expired September 24th, 1849.

J. Spiller, Battersea, engineer, for an improvement, or improvements, upon boilers for generating steam, or heating water or other fluids, for useful purposes. Patent dated September 24th, 1835. Expired September 24th, 1849.

THE BRITANNIA TUBULAR BRIDGE.—Active preparations are being made at the Menai Straits connected with the renewed attempts at raising the tube to its permanent level, a process looked forward to with considerable anxiety, in consequence of the late misadventure. The new cylinder intended to replace the one that sprung was cast on Saturday. It has to be a week in sand to get annealed, by which process it will become toughened. Every precaution has been taken, and the most improved method of casting has been adopted, so as to confer all additional security. Some modifications have been carried out by the engineers, Messrs. Easton and Amos, in the bottom of the press, to counteract the effect of contraction in such large masses of metal, and which is believed to have been the superinducing cause of the bursting of the last cylinder. When in perfect readiness, the new cylinder will be shipped on board a steamer direct to the Straits. It will be a machine of prodigious power, of cast iron, in one piece, of from 16 to 20 tons weight, and capable of sustaining a pressure of 9,000 or 10,000 lb. on the inch. Since the accident, last month, the whole range of scaffolding, and all the immense machinery, have received such a superabundance of strength for the next trial that any recurrence of the recent casualty is looked upon as improbable. Precautions have also been taken by Mr. Stephenson to guard against any future damage, either to the tube or those who will be engaged in raising it, seeing that, in addition to the loss of life that occurred on the last occasion, Mr. E. Clark, the acting engineer, who was standing on one of the cross-heads of the press, had a narrow escape, being suddenly thrown on to the boiler in the engine-room. The tube is now raised about one quarter of what will be its actual ultimate elevation, and is resting 25 feet above high water. It has subsequently to be hauled up 75 feet higher; and it is expected that in twelve days from the commencement of operations it will attain its proper level. A great many persons of note have been to see the tubes and stupendous works; among them the Marquis of Anglesey, Lord John Russell, Lord Paget, Mr. Milner Gibson, M.P., and Sir John Burgoyne. The propositions that have recently been made of lifting the huge fabric by means of pontoons, tide raised, and bearing up the tube on suitable scaffolding, are by no means new or unthought of. They would work well in a model, but would be quite impracticable, for many reasons, on the scale required.—*Mining Journal.*

DISTILLATION OF PEAT.—We are not aware that any experiments have yet been made in Scotland, and we do not expect any hasty expenditure among our cautious hands in such an adventure; but, in spite of the dearth of full information on the subject, we have received, privately, the substance of an opinion given by Dr. Anderson, the eminent chemist connected with the Highland Society's Agricultural Laboratory. Chemists are perfectly familiar with the fact that all the substances named may be found in peat; but the possibility of their profitable extraction is another question. Mr. Reece's patent was taken for distilling peat (probably in cylinders of iron, such as are used for making wood vinegar), and, of course, the expenditure of £8 applies merely to the crude process of distillation; but the most offensive and troublesome operation remains in separating the different component parts of the result, and purifying them. £32 is reckoned for the carbonate of ammonia produced; but this cannot be directly obtained, and would not obtain a market till converted into sulphate by the expenditure of a large quantity of sulphuric acid. Some of the oils are of little value, and the same as those obtainable from coal-tar, which the manufacturers have difficulty in getting rid of, and would be reduced in value by any increase of production. The gas, estimated at £8, is perfectly useless in the situations where it would be produced—a circumstance which would reduce the value of all the products calculated at the market rate. Finally, from those gross profits fall to be deducted the value of buildings for conducting the operations. On the whole, the statement in Parliament appears undoubtedly very much exaggerated—most unconsciously, we are convinced, on the part of Lord Ashley, at least; and, in the present state of our information, cannot with safety be taken as a sound foundation for any experiment on a large scale. As regards Scotland, besides, we are quite in the dark, for the mechanical condition of the peat is, in many cases, very dissimilar from that of Ireland, and its chemical properties may be equally so. At all events, of this we may be certain, the valuable character of the subsoil, saturated, as it is represented to be, with ammonia, in Ireland, is not discoverable under our peat mosses generally. We fear, for the present, we must be content with the uses to which our peat has hitherto been applied, and they are not despicable. If the flavour of the peat-reek is no longer required for our good home-brewed produce of the black pot, it still affords a cheap and wholesome fuel in many remote places. In those more frequented it has been successfully applied to drainage in the shape of tiles; and the agriculturist has, since the days of Kaimes and Maconochie, found it a most valuable foundation of the midden-heap. To this use of the substance let all who can reach it diligently turn their attention, at a time when the sound opinion is more and more gaining ground, that to turn straw into dung, without passing it through the stomachs of our stock, is mere waste, and every available mixture with special and farmyard manures is eagerly sought after, to increase their bulk at the smallest cost. Where the peat mosses stretch over a large surface, and capital can be obtained, we have the further resource, by draining, liming, and top dressing, of raising an entirely new and sound arable surface on the bog, at a rate which the produce will speedily remunerate. In this way the fable of the father may be realized, who, leaving in his will a treasure, said to be hid in a field, bequeathed in another shape, to his successors, in the augmented return produced by their labours in seeking it.—*Montrose Standard.*

TO CORRESPONDENTS.

"A Student."—Procure "Outlines of Botany, for the Use of Families and Schools. By Thomas Graham, M.R.C.S. and L.S.A." This is one of the best elementary works on the subject.

"J. B., Manchester."—Balm of Gilead is a synonymous term for balm of Mecca. The genuine balm of Mecca is the juice of the Amyris gileadensis, and is obtained by cutting the bark of the tree with an axe. It is scarce and costly, and *none* of it ever reaches this country as an article of commerce. There are only two shops in Constantinople at which the genuine balsam can be obtained. Its price is exorbitant, one grain being charged five Turkish piasters=1*s*. 0½*d*. That which is sent to England is obtained by boiling the twigs of the balsam-tree in water. The real balm of Mecca is of a clear gold colour, and possesses a penetrating and delicate fragrance, and a sharp, bitter, astringent taste. A drop of it let fall on the surface of hot water spreads itself over the whole surface like a thin film of oil, but contracts again on the water cooling. It dissolves completely in fatty and essential oils, which then assume the peculiar flavour of the balsam. A tolerably good imitation of balm of Mecca may be prepared as follows:—Take yellow rosin, one pound; bright gum benzoïn, four ounces; best liquid storax, two ounces; essence of lemons, three ounces; oil of rosemary, two ounces; oil of caraway, and oil of cassia, of each one ounce. Melt the rosin at a gentle heat, and keep it in that state for fifteen minutes; remove the heat, and add the benzoin, previously powdered and rubbed up with an equal weight of tincture of benzoïn; when thoroughly incorporated add the rest of the ingredients. Dilute the mass to a proper consistence with spirit of wine, and strain through flannel.

"P. Q."—We cannot advise you in the matter.

"Tyro."—Fresenius's Qualitative and Quantitative Chemical Analysis, edited by Lloyd Bullock; Graham's Elements of Chemistry; Liebig and Gregory's last edition of Turner's Chemistry.

"Mr. Waltham, Brighton."—You may decolorate the matter in question by simple filtration through animal charcoal.

THE CHEMICAL TIMES is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary or scientific communications to be addressed to the Editor, 320, Strand.

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ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXXVII.

(LECTURE CX.)

VEGETO-ALKALIS—(*Continued*).

WOLF'S-BANE—(*Continued*).

The wolf's-bane of the mountains is generally preferred to that which grows in our gardens.

The leaves of the plant lose five sixths of their weight by drying. The process of desiccation deprives the leaves of the acrid volatile principle of the Ranunculaccæ. It has not yet been ascertained experimentally what change the loss of this principle may cause in the properties of the plant.

SECTION I. — PREPARATIONS WHICH CONTAIN THE WHOLE SUBSTANCE OF THE PLANT.

POWDER OF WOLF'S-BANE.

Reduce the dried leaves to powder without leaving a residue. The Codex directs the pulverization to be carried no further than up to three fourths of the mass; but I have found that the difference between the first powder and that of the residue kept according to the directions of the Codex is very trifling indeed.

SECTION II.—PREPARATIONS OBTAINED BY THE ACTION OF WATER UPON THE PLANT.

The medicinal principles of wolf's-bane are readily dissolved by water. The clarified juice of the fresh plant appears to be very similar to the liquor obtained by the action of water upon the dry plant, except in this, that the latter does not contain (or, at all events, contains only a minute fraction of) the volatile acrid principle of the Ranunculaceæ which is found in the former.

EXTRACT OF WOLF'S-BANE.

The extract of the Codex is prepared with the turbid juice of the fresh plant, which is evaporated on plates in the stove. This extract retains a part of the acrid volatile principle, but in variable proportions.

The extract prepared with the liquor obtained by moistening the powder of wolf's-bane with half its weight of water, heaping it lightly, and lixiviating with water at 68° Fahrenheit, is a different product from the extract of the Codex, and should never be substituted for the latter except upon the express direction of the physician.

The liquor obtained from 100 grammes of powder of wolf's-bane by lixiviation with distilled water left upon evaporation forty-four grammes of extract of firm consistence. On the other hand, I obtained from 100 grammes of extract of the non-depurated juice of the fresh plant left by solution in water and subsequent evaporation of the solution 69.6 grammes of extract. Accordingly we may assume that, leaving out of the question the differences which these two sorts of extract may present in their composition, one part of extract prepared with the non-depurated juice of the fresh plant represents :—

1.58 of the dry plant,
0.7 of the extract prepared with the liquor obtained from the powder of wolf's-bane by lixiviation ;

and that one part of the latter represents :—

2.27 of the dry plant,
1.42 of the extract prepared with the non-depurated juice of the fresh plant.

The extract of wolf's-bane is prescribed particularly against rheumatic and nervous affections. The usual dose is from twenty to fifty milligrammes at first, but may speedily be raised much higher.

SYRUP OF WOLF'S-BANE.

Take of Extract of wolf's-bane (prepared with the non-depurated juice), 10 centigrammes.
Alcohol at 56 Cent., 25 centigrammes.
Sugar syrup, 30 grammes.

Dissolve the extract in the alcohol, and mix the solution with the syrup.—(Mouchon.)

SECTION III.—PRODUCTS OBTAINED BY THE ACTION OF ALCOHOL UPON THE PLANT.

The active principles of wolf's-bane are readily soluble in alcohol. The liquor obtained by the maceration of the fresh plant in alcohol contains the whole of the acrid volatile principle of the plant.

ALCOHOLIC EXTRACT OF WOLF'S-BANE.

This extract is prepared by lixiviating the powder of wolf's-bane with alcohol at 56 Cent.

From 100 parts of powder I obtained 35 parts of extract of firm consistence. Leaving out of the question the differences of composition which this extract may present, we may assume that one part of the alcoholic extract represents :—

2.85 parts of dried leaves or powder of wolf's-bane,
1.28 of extract prepared with the liquor obtained by lixiviating the powder with distilled water,
1.75 of extract prepared with the non-depurated juice of the fresh plant.

LOMBARD'S ALCOHOLIC EXTRACT OF WOLF'S-BANE.

Take of the non-depurated juice of the fresh plant, any quantity you like.

Coagulate the juice by a slight ebullition ; strain ; evaporate the liquor in the water-bath to the consistence of an extract; dissolve the extract in alcohol, and evaporate the alcoholic solution at a low temperature to the consistence of an extract.

ALCOHOLIC TINCTURE OF WOLF'S-BANE.

Take of Dry leaves of wolf's-bane, 1 part.
Alcohol at 56 Cent., 5 parts.

Let the leaves macerate in the alcohol for fifteen days; strain with expression, and filter.

One part of this tincture represents : —

0.20 of the dry leaves or powder of wolf's-bane,
0.07 of the alcoholic extract of wolf's-bane.

DR. TURNBULL'S TINCTURE OF WOLF'S-BANE.

Take of The dry roots of wolf's-bane, 1 part.
Rectified alcohol, 2 parts.

Dr. Turnbull employs this tincture in frictions as a substitute for aconitina.

ALCOHOLATURE OF WOLF'S-BANE.

Take of Fresh leaves of wolf's-bane,
Alcohol at 88 Cent., of each equal parts.

Crush the leaves to a pulp, and let this macerate in the alcohol for eight to ten days ; strain ; filter. The alcoholature of wolf's-bane contains, besides the fixed principles of the plant, the whole of the acrid volatile matter. It is proper to remark that this preparation is totally different from the alcoholic tincture of wolf's-bane, and that it ought never to be substituted for the latter, except, of course, upon the express direction of the physician.

1 gramme of the alcoholature represents :—

3.08 grammes of the fresh plant.
6.03 grammes of the dry plant.
2.20 grammes of alcoholic extract.

SECTION IV.—PREPARATIONS OBTAINED BY THE ACTION OF ETHER UPON THE PLANT.

ETHEREAL TINCTURE OF WOLF'S-BANE.

Take of Powder of wolf's-bane, 1 part.
Sulphuric ether, 4 parts.

Prepare the tincture by the method of displacement.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON THE INORGANIC CONSTITUENTS OF ORGANIC BODIES.

By H. ROSE,

Professor of Chemistry in the University of Berlin.

[*Concluded from page* 219.]

APPENDICES TO PROFESSOR ROSE'S PAPER.

APPENDIX XIII.

EXAMINATION OF THE INORGANIC CONSTITUENTS OF COW'S MILK. BY M. WEBER.

The cows from which the milk was procured were fed with the refuse of a brewery in addition to the ordinary stall-fodder. The milk was not skimmed, but evaporated at once and carbonized.

Aqueous Extract.—The washing required to be continued for an extraordinary length of time. The residue of the evaporated extract consisted of:—

Chloride of potassium	41.42	or of	K Cl..... 41.42
Chloride of sodium ..	13.85		Na Cl..... 13.85
Potash.....	29.66		$3\,KO + PO_5$ 21.60
Phosphoric acid	7.25		KO, SO_3 .. 0.36
Sulphuric acid	0.17		KO, CO_2 .. 22.83
Carbonic acid	7.27		

Muriatic Extract.—No evolution of carbonic acid could be perceived on the addition of the muriatic acid. The constituents were :—

Potash	6.29
Soda	12.19
Lime	36.70
Magnesia	3.26
Peroxide of iron.....	0.30
Phosphoric acid.....	41.26
	100.00

Hence the muriatic acid had only dissolved phosphates.

Residuary Carbonaceous Mass.—It yielded:—

Potash	33.13
Soda	9.01
Lime	16.58
Magnesia	3.40
Peroxide of iron.....	1.10
Phosphoric acid	36.60
Silica	0.18
	100.00

Thus the anoxidic portion of the milk, after oxidation, was of the same composition as the teleoxidic.

The following are the results of the examination of the milk :—

Extracted by water	34.17
Extracted by muriatic acid.....	31.75
Ash of the remaining carbonaceous mass.....	34.08
	100.00

The whole of the constituents were :—

		Oxygen.	
Chloride of potassium	14.18		
Chloride of sodium	4.74		
Potash.....	23.46	3.97	11.51
Soda.....	6.96	1.78	
Lime	17.34	4.87	
Magnesia.....	2.20	0.85	
Peroxide of iron.....	0.47	0.14	
Phosphoric acid.....	28.04	15.71	17.51
Sulphuric acid	0.05	0.02	
Carbonic acid	2.50	1.80	
Silica	0.06	0.03	
	100.00		

Hence the phosphoric acid of the bases is to that of the acids nearly as 3 : 5. The teleoxidic portion of the milk contains *c*-phosphates, and the anoxidic portion yields by oxidation *c*-phosphates also.

Thus milk is a meroxidic substance. We might almost call it a hemioxidic substance, if the large quantity of the alkaline chlorides contained in the aqueous extract were excluded from the teleoxidic portion, to which they evidently do not belong.

The large amount of phosphoric acid in the teleoxidic portion, and the considerable quantity which the anoxidic portion yields on oxidation, are remarkable. It is hence evident, as has frequently been remarked, how well the milk is adapted for effecting the ossification of the bones in the mammalia.

Whilst in the blood the bases predominate over the acids, in the flesh we find little else than pyrophosphates, and in the milk the bases for the most part form *c*-phosphates.

Appendix XIV. and XV.

EXAMINATION OF THE INORGANIC CONSTITUENTS OF THE WHITE AND YOLK OF HEN'S EGGS. BY M. POLECK.

These experiments were among the first made by the method of carbonization, and were instituted before the process was perfected; they do not, therefore, deserve too much confidence, although performed with great care.

The principal source of error consists in the fact, that in some of the analyses the alkali contained in the muriatic extract, not having been suspected to exist there, was overlooked; moreover, the exhausted carbonized mass, being burnt in an atmosphere of oxygen, would allow of the volatilization of a considerable portion of the alkaline phosphates. The separation of the white from the yolk can be easily effected, by well boiling the eggs in water until they become hard.

The relative proportion of the white and yolk was not exactly the same in all the eggs. The following results were obtained in regard to this point:—

Four eggs yielded	... 60.60	per cent.	white
" "	... 39.40	"	yolk
Sixteen eggs yielded	... 58.43	"	white
" "	... 41.57	"	yolk
Fourteen eggs yielded	... 59.42	"	white
" "	... 40.58	"	yolk

White of Egg.—It yielded in two instances:—

	I.	II.
Chloride of potassium	47.19	51.33
Chloride of sodium	10.66	17.13
Soda	24.22	17.71
Sulphuric acid	1.61	1.67
Carbonic acid	14.66	10.49
Silica	0.17	
	98.51	98.53

or

Chloride of potassium	47.19	51.33
Chloride of sodium	10.66	17.13
Carbonate of soda	39.23	28.01
Sulphate of soda	2.83	2.96
Silica	0.17	
	100.08	99·43

In both analyses a little more carbonic acid was found than could be combined with the alkali. This is remarkable; because in the aqueous extracts of the carbonized mass of other organic substances considerably less carbonic acid was frequently found than was requisite for the saturation of the alkali, a considerable portion of the carbonic acid being frequently reduced to carbonic oxide by the carbon.

Muriatic Extract.—As in the first experiment, the presence of the alkalis was overlooked; the result of the second only is given:—

Potash	4.95
Soda	9.13
Lime	10.53
Magnesia	11.61
Carbonate of lime	11.14
Carbonate of magnesia	15.48
Peroxide of iron	2.75
Phosphoric acid	23.85
Silica	10.56
	100.00

Residuary Carbonaceous Mass.—It was not incinerated with platinum, but in oxygen gas; hence there was a loss. I have already remarked that the proteine substances of vegetables and animals alone appear to be meroxidic bodies; all others appear to be of a teleoxidic nature. The white of hen's eggs, however, forms a remarkable exception to all the other proteine substances which have been examined, in consequence of the very small quantity of anoxidic substance which it contains. The amount of ash is very small. In both experiments the charred mass contained silica in the form of sand, which, however, was deducted from the ash. The following was the composition of the two ashes:—

	I.	II.
Potash	11.93	16.76
Soda	10.83	5.48
Lime	12.21	8.21
Magnesia	24.15	9.02
Peroxide of iron	1.41	5.64
Phosphoric acid	30.73	37.24
Silica	8.71	17.63
	99.94	99.98

These results differ very considerably; the cause must be determined by future experiments.

On arranging the constituents in the form of salts we find in the first experiment *b*-phosphoric acid and some very basic silicates; in the second only *b*-phosphoric acid and less basic silicates.

The quantities obtained were:—

	I.	II.
Extracted by water	81.52	82.19
Extracted by muriatic acid	14.33	15.52
In the ash of the remaining mass	4.15	2.29
	100.00	100.00

The components of the subject of the second analysis, as obtained in the three operations, were:—

Chloride of potassium	25.67
Chloride of sodium	8.57
Potash	5.43
Soda	12.49
Lime	6.25
Magnesia	7.03
Peroxide of iron	2.09
Phosphoric acid	15.28
Sulphuric acid	0.84
Carbonic acid	9.01
Silica	7.05
	99.71

In accordance with these investigations, the white of hen's eggs, although decidedly a proteine substance, must be enumerated amongst the almost teleoxidic substances. The large quantity of silica in the white of egg, both in the teleoxidic and the anoxidic portion, is remarkable. The white of birds' eggs is equally as requisite for the formation of the feathers, which, according to recent investigations, contain a large amount of silica, as the milk of the mammalia is for the production of the bones.

Yolk of Egg.—Aqueous Extract.—It exerted a strongly acid reaction upon litmus paper, and contained a considerable quantity of the earthy phosphates in solution, which were not on this occasion separated, but added to the muriatic extract. The dry mass fused into a transparent vitreous mass at a low red heat. It consisted of:—

Potash	10.38	9.77
Soda	5.62	7.65
Lime	11.72	11.80
Magnesia	1.45	2.04
Peroxide of iron	0.59	0.95
Phosphoric acid (undetermined)	68.74	
	100.95	

The phosphoric acid formed metaphosphates with the bases, excepting with the peroxide of iron. In the extract itself they did not exist in this form, but in that of acid *b*-phosphates, for it strongly reddened litmus paper; they were, however, contained in that state in the solution of the fused residue of the evaporated mass. In accordance with the second experiment, we obtain the following arrangement for the salts:—

Monobasic phosphate of potash	24.57
Monobasic phosphate of soda	25.16
Monobasic phosphate of lime	41.73
Monobasic phosphate of magnesia	9.08
Perphosphate of iron	1.79
	102.33

The calculated amount of phosphoric acid is 70.18 per cent.; experiment gave 68.74 per cent.

Muriatic Extract.—The following is the composition of that of the second experiment:—

Lime	22.32
Magnesia	2.98
Peroxide of iron	3.71
Phosphoric acid	70.97
	99.98

These salts are also metaphosphates, the iron compound probably being excepted. They correspond to:—

Monobasic phosphate of lime	78.94
Monobasic phosphate of magnesia	13.30
$2Fe_2O_3, 3PO_5$	8.66
	100.90

The calculated amount of phosphoric acid would be 71.89 per cent.; that found was 70.97 per cent.

Residuary Carbonaceous Mass.—This, like the white of egg, was also burnt in oxygen gas. Hence the results obtained in the two experiments differ; in the first much less ash was found than in the second. The latter consisted of:—

Potash	7.96
Soda	6.75
Lime	13.04
Magnesia	2.04
Peroxide of iron	0.99
Phosphoric acid	64.13
Silica	2.76
	97.67

These are also mostly metaphosphates; only a very small quantity of the bases can be combined with pyrophosphoric acid.

The following are the results of the experiments:—

	I.	II.
Extracted by water from the carbonized yolk	63.73	40.95
Extracted by muriatic acid	13.73	8.05
Ash of the remaining mass	22.54	51.00
	100.00	100.00

These results differ very considerably, yet they show that the yolk undoubtedly belongs to the meroxidic substances.

The inorganic constituents of the entire mass of the carbonized yolk in the second experiment were:—

Potash	5.94
Soda	4.82
Lime	15.79
Magnesia	2.36
Peroxide of iron	1.85
Silica	0.92
Phosphoric acid	68.26
	99.94

These are metaphosphates. The yolk of egg contains more phosphoric acid than any other organic substance treated of in this memoir.

INORGANIC CONSTITUENTS OF YEAST (FROM BERLIN PALE BEER). BY B. W. BULL, OF NEW YORK.

The yeast was washed with distilled water; the washing cannot, however, be perfectly effected, because the pores of the filter become so readily stopped up.

Aqueous Extract.—This did not affect litmus paper; during evaporation it deposited earthy

phosphates, which were added to the muriatic extract. It consisted of:—

Chloride of sodium	0.69	NaCl	0.69
Potash	45.79	$2KO+PO_5$	40.18
Soda	0.29	$KO+PO_5$	57.55
Phosphoric acid	52.22	$2NaO+PO_5$	0.52
	98.99		98.94

Hence the aqueous extract consisted essentially of *a* and *b* phosphate of potash.

Muriatic Extract.—It was composed of:—

Potash	33.48
Soda	0.39
Lime	9.69
Magnesia	4.79
Peroxide of iron	0.52
Sulphuric acid	0.20
Phosphoric acid	50.93
	100.00

Part of the phosphoric acid is combined with the bases in the form of *b* and part in that of *a* phosphates. It is not easy to explain why these are not extracted from the carbonized mass with the other *a*-phosphates by water. The calculated salts are:—

Bibasic phosphate of potash	50.39	PO_5	28.56
Monobasic phosphate of potash	11.40	KO	33.23
Monobasic phosphate of soda	1.28		
Bibasic phosphate of lime	22.04		
Bibasic phosphate of magnesia	13.09		
Perphosphate of iron	1.46		
Sulphate of potash	0.44		
	100.10		

Residuary Carbonized Mass.—This consisted of:—

Potash	28.71
Soda	0.60
Lime	2.35
Magnesia	6.36
Peroxide of iron	1.16
Phosphoric acid	60.82
	100.00

or

Monobasic phosphate of potash	72.14	PO_5	43.43
		KO	28.71
Monobasic phosphate of soda	1.97		
Bibasic phosphate of magnesia	13.91		
Monobasic phosphate of magnesia	5.18		
Phosphate of lime ($8CaO, 3PO_5$)	4.60		
Perphosphate of iron	2.20		
	100.00		

The phosphate of lime is in this case assumed as having the same composition as that precipitated from the muriatic solution by ammonia.

The entire results of the experiments were:—

Extracted by water	27.24
Extracted by muriatic acid	37.70
In the ash of the residuury carbonaceous mass	35.06
	100.00

The whole constituents were:—

Chloride of sodium	0.19
Potash	35.16
Soda	0 42
Lime	4.47
Magnesia	4.05
Peroxide of iron	0.61
Sulphuric acid	0.08
Phosphoric acid	54.74
	99 72

These results agree very well with those obtained by Mitscherlich.

Yeast is therefore a meroxidic substance, and possesses most analogy with flesh in regard to its inorganic constituents.

ON MYRICINE.

By BENJAMIN COLLINS BRODIE, Esq.*

I have placed the investigation of the Chinese wax between that of the cerotic acid and of the residue of the beeswax which remains after that substance has been separated from it. By the saponification of this Chinese wax we procure, as I have shown, an acid identical with the cerotic acid from beeswax, and also the alcohol of this acid, so that the chemical history of these substances is closely connected. We have, moreover, in the Chinese wax to deal with a substance found in nature in a state of great purity, the products of the decomposition of which by alkalis and by heat can readily be prepared and examined. The knowledge of the relation of these products to one another throws great light upon the nature of myricine, which is not a pure substance, and the chemical relations of which are complex.

I have stated that the first extracts of wax with alcohol give with acetate of lead an abundant precipitate in a hot alcoholic solution. This affords us a ready test of the presence of the cerotic acid. The wax may be long boiled with alcohol before the whole of the cerotic acid is removed. If, however, this process of boiling and decantation be continued, a time will come when the acetate of lead will cease to give any precipitate whatever in the hot alcoholic extract. The residue after this extraction I speak of as myricine. It is advisable to continue for two or three times the operation of boiling and decanting, even after the acetate gives no precipitate, the cerotate of lead not being entirely insoluble in the hot solution.

The myricine thus prepared is a greenish substance of about the consistency of wax, uncrystalline, still possessing a slight smell of wax, and of a melting-point of 64° C. This substance is hardly acted on by dilute potash. It is, however, saponified by boiling with strong potash, and more readily by an alcoholic solution of the alkali. The saponification may also be effected by melting it with hydrate of potash, as in the case of the Chinese wax. The products are the same in whichever way the operation be conducted.

If the soap from the saponification of the myricine be treated in the same manner as the similar soap from the Chinese wax, it also will be found to contain two substances, an acid and another substance which is contained in the ether with which the baryta salt is extracted. On attempting to purify these substances respectively by crystallization out of alcohol, ether, or absolute alcohol, great variations in the melting-point both of the acid and basic substance will be observed. And careful observation shows that these are not, as in the case of the Chinese wax, substances in a state of comparative chemical purity, but are mixtures, both in the case of the acid and of the other matter, of at least two bodies difficultly separable from one another. It is the separation of these substances which gives a peculiar difficulty to the investigation of the nature of myricine.

Although the acid and basic products of the saponification may thus, as in the case of the Chinese wax, be separated by precipitation of the soap by a baryta salt, in the case of the beeswax these substances admit of a simpler method of separation, without which method, so difficult is it to wash perfectly out the baryta salt, that I question whether the substances could be obtained pure. The soap, in whatever way the saponification may have been effected, and after the alcohol, if any, used for the saponification has been distilled off, is to be dissolved in a large quantity of water, and the boiling solution decomposed by an acid. The melted mass which results from this operation, after having been repeatedly boiled out with water, is to be dissolved in a large quantity of hot alcohol. An abundant precipitate appears in the cold fluid from which the solution is to be filtered, and the precipitate repeatedly redissolved and recrystallized out of alcohol. The precipitate will at length be found to consist, almost entirely, of the basic portion of this waxy matter. The alcoholic solution contains the acid.

I shall proceed to give the simplest method by which the pure substances may be obtained, and those experiments which I have made upon their constitution, which I think can leave no doubt upon the mind of the chemist as to the true nature of that matter of which by far the greater portion of the myricine, and, indeed, of the wax itself, consists.

The first separation of the products of saponification may be made, as I have stated, by combining the acid with baryta and washing out the resulting salts with ether.

MELISSINE.

If the substance contained in the ethereal solution, with which the baryta salt is washed out, be crystallized out of ether or alcohol, the melting-point will be considerably raised, from below 70° C. to above 80°, by repeated crystallization. The difficulty with which the melting-point was raised made it evident that the substances contained in the solution were to be separated only by long crystallization and a careful attention to the variations of the melting-points. I made various experiments to discover a satisfactory method of purification. At length I found that if the ethereal solution be filtered while yet warm, and when only a small portion of matter has crystallized out, a substance remains on the filter of a melting-point of 85° C. of a satiny lustre, and of highly crystalline appearance. It is with difficulty that even a small portion of substance can be thus obtained, and it is necessary to use, during the filtration, a hot water apparatus to prevent the precipitation of the whole matter dissolved. I have never been able to succeed in further raising the melting-point of this body, and, therefore, regard it as pure. In this condition it crystallizes on cooling from the melted state, and its crystallization is marked by striæ parallel to the line of cooling; it being in all respects, but the melting-point, similar in appearance to cerotine as procured from Chinese wax.

I give this method of preparing this substance as it was the first I adopted, and as it can thus be procured in a high state of purity. I afterwards, however, discovered the use of rectified coal-naphtha as a solvent for these substances; and by far the best and simplest method of procuring the body is by crystallization out of that solvent of the precipitate from the alcoholic solution which I have before mentioned, as procured by dissolving in alcohol the wax matter obtained by decomposing by an acid the soap from the myricine. By alcohol the basic portion of the saponified myricine is separated from the acids. By naphtha the substance of 85° melting-point is separated from another and probably an analogous body, of which I shall speak hereafter.

This substance gave to analysis the following numbers. The result is the same in whatever way the substance is prepared:—

	Substance.	CO_2.	HO.
I.	0.2685 grm. gave..	0.8075	0.341
II.	0.2597 grm. gave..	0.7839	0.3326
III.	0.278 grm. gave..	0.84375	0.35325
IV.	0.2584 grm. gave..	0.7812	0.325
V.	0.2511* grm. gave..	0.7595	0.3215
VI.	0.2617† grm. gave..	0.7870	0.3295

* From the "Philosophical Transactions" for 1849, part i.; having been received by the Royal Society May 11, and read November 23, 1848. For the preceding parts of Mr. Brodie's paper on the Chemical Nature of Wax, see *Chemical Times*, vol. iv., page 256.

* This substance was procured directly from wax, from which it may be obtained and purified in the same manner as from the purified myricine, which is the simplest way of procuring the substance if the other products of saponification are not required.

† This substance was procured from the Ceylon wax mentioned in a former paper.

which give in 100 parts :—

	I.	II.	III.	IV.	V.	VI.
C...	82.02	82.40	82.77	82.43	82.48	82.01
H...	14.11	14.25	14.11	13.97	14.22	13.99
O...	3.87	3.35	3.12	3.60	3.30	4.00
	100.00	100.00	100.00	100.00	100.00	100.00

These analyses agree with the formula :—

	Atomic Weight.	Calculated.
C_{60}	360	82.19
H_{62}	62	14.15
O_2	16	3.66
	438	100.00

This substanec I propose to call melissinc.

MELISSIC ACID.

Melissine, heated with lime and potash, as the similar experiment was made with cerotine, is, like that body, converted into an acid. This acid has a similar appearanee to the wax acid already described. It has, however, a much higher melting-point, namely, 88°-89° C. The preparation of the substanee need not be again described :—

	CO_2.	HO.
I. 0.655 grm. gave	0.7764	0.3104
II. 0.2507 grm. gave (another preparation)	0.728	0.2507
III. 0.2508 grm. gave	0.7333	0.3077
IV. 0.2396 grm. gave (another preparation)	0.7026	0.2885
V. 0.258 grm. gave		0.3085

whieh give in 100 parts :—

	I.	II.	III.	IV.	V.
Carbon	79.74	79.19	79.74	79.97	—
Hydrogen	13.00	13.32	13.63	13.40	13.28
Oxygen	7.26	7.49	6.63	6.63	—
	100.00	100.00	100.00	100.00	100.00

These analyses agrec with the formula :—

	Atomic Weight.	Calculated.
C_{60}	360	79.64
H_{60}	60	13.27
O_4	32	7.09
	452	100.00

I prepared the silver salt of this acid in precisely the same manner as was prepared the silver salt of the cerotic acid.

I. 0.6085 grm. gave 0.1175 silver.

II. 0.678 grm. gave 0.1315 silver.

III. 0.58625 grm. gave (another preparation) 0.11575 silver, which give in 100 parts :—

	I.	II.	III.
Silver	19.30	19.39	19.74

	CO_2.	HO.
I. 0.4619 grm. of the salt gave	1.0863	0.4464
II. 0.484 grm. of the salt gave	1.13375	0.471

giving in 100 parts :—

	I.	II.
Carbon	64.13	63.90
Hydrogen	10.73	10.81
Oxygen and silver	25.14	25.29
	100.00	100.00

These analyses lead to the formula :—

$C_{60}\ H_{59}\ O_4\ Ag.$

	Calculated.
C_{60}	64.38
H_{59}	10.55
O_4	5.77
Ag	19.30
	100.00

The formula, therefore, of the hydrated acid is $C_{60}\ H_{60}\ O_4$. This acid I call melissic acid.

CHLOR-MELAL.

By the action of chlorine on melissine a perfectly analogous result is obtained to that obtained by the action of chlorine on cerotine. The substance undergoes also a similar change in appearance, being converted into a resin.

The substance was prepared and analyzed with a view to confirming the formula of the body :—

	CO_2.	HO.
I. 0.4136 grm. gave	0.589	0.175
II. 0.4263 grm. gave	0.602	0.1835

which give in 100 parts :—

Carbon	38.83	38.51
Hydrogen	4.70	4.78
Oxygen and chlorine	56.47	56.71
	100.00	100.00

I. 0.6663 grm. gave 1.4821 grm. of chloride of silver equivalent to 0.3665 grm. of chlorine.

II. 0.6075 grm. gave 1.341 grm. of chloride of silver equivalent to 0.3316 grm. of chlorine.

III. 0.6475 grm. gave 1.4375 grm. of chloride of silver equivalent to 0.3555 grm. of chlorine.

These determinations correspond in 100 parts to :—

	I.	II.	III.
Chlorine	55.01	54.58	54.91

These analyses lead to the formula :—

$$C_{60}\begin{cases} H_{45\cdot5} \\ Cl_{14\cdot5} \end{cases} O_2.$$

C_{60}	38.50
$H_{45\frac{1}{2}}$	4.86
$Cl_{14\frac{1}{2}}$	54.90
O_2	1.74
	100.00

As in the case of the cerotine, by the action of chlorine two equivalents of hydrogen are removed without replacement by chlorine, while the further action is an action of substitution, the substanee being the analogue of chloral.

The products of the distillation of melissine are analogous to those of the distillation of cerotine. The substanee partly distils over unaltered, and is partly, with the loss of water, converted into solid hydrocarbon. Sulphuric acid also combines with it under the same conditions as with the other wax alcohol.

PALMITIC ACID FROM THE SAPONIFICATION OF MYRICINE.

Melissine is soluble with such great difficulty, in every solvent suitable for washing out the baryta salt from the wax soap, that its separation from the acid cannot in this manner be effected. It may, however, be separated by simple crystallization. The alcoholic solution from which the melissine has crystallized out, after having been considerably concentrated and again filtered from any precipitate produced on cooling, contains hardly a trace, if any, of that substance. The acids are very soluble in alcohol, and it is only on great concentration that they crystallize from that solvent. The alcohol is to be distilled off to the point of crystallization, and the first portions only of the fat acid selected for the preparation of the pure substance. The acid is to be boiled with potash, combined with baryta, and washed out with ether.

On decomposing the baryta salt with hydrochloric acid a fat acid separates, having the appearance of margaric or palmitic acid, which latter body is in truth the principal acid of the wax. It is, however, mixed with another acid of a lower melting-point, for which reason it is desirable, as I have mentioned, to use in its preparation only the first crystallization of the acid. From this other body it is separable with the greatest difficulty; but by long-continued crystallization from ether an acid may be obtained of the melting-point of 62° C., beyond which point it cannot be raised. This acid gave to analysis the following results :—

	CO_2.	HO.
I. 0.2486 grm. gave	0.6877	0.278
II. 0.2605 grm. gave	0.7145	0.290
III. 0.2542 grm. gave	0.6937	0.2847

giving per cent.—

	I.	II.	III.
Carbon	75.42	74.80	74.43
Hydrogen	12.43	12.36	12.43
Oxygen	12.15	12.84	12.14
	100.00	100.00	100.00

The silver salt was made, as in the other cases, by precipitation from the ammoniacal solution of the acid :—

I. 0.6885	grm. of this salt gave 0.2005	silver
II. 0.66025	grm. of the same gave 0.1920	silver
III. 0.623	grm. of another preparation gave 0.182	silver
IV. 0.609	grm. of the same gave 0.17625	silver
V. 0.671	grm. of another preparation gave 0.197	silver
VI. 0.744	grm. of the same gave 0.2185	silver

giving in 100 parts :—

I.	II.	III.	IV.	V.	VI.
29.12	29.23	29.21	28.94	29.35	29.36

	CO_2.	HO.
I. 0.4458 grm. of the first preparation gave	0.869	0.3495
II. 0.4463 grm. of the same preparation gave	0.870	0.3555
III. 0.5896 grm. of the second preparation gave	0.7545	0.3065

whieh eorrespond in 100 parts to—

	I.	II.	III.
Carbon	53.16	53.22	52.82
Hydrogen	8.70	8.85	8.75
Silver and oxygen	38.14	37.93	38.43
	100.00	100.00	100.00

The silver salt is by no means insoluble in the ammoniacal solution, so that in the making of the salt by this method a certain separation of the substanee is effected. If any impurity were presented, it probably would be detected on analyzing the acid as again separated from the silver salt :—

	CO_2.	HO.
I. 0.2523 grm. of the acid thus separated gave	0.6970	0.285
II. 0.228 grm. of the same gave	0.6255	0.257

giving in 100 parts :—

	I.	II.
Carbon	75.38	74.82
Hydrogen	12.56	12.52
Oxygen	12.06	12.66
	100.00	100.00

These analyses, as well as those of the acid previous to combination with silver, agree with the formula of palmitic acid, $C_{32}\ H_{32}\ O_4$, with which substance the melting-point of the acid also identifies it. The calculated numbers in parts per cent. of the acid and silver salt are :—

C_{32}	192	75.0
H_{32}	32	12.5
O_4	32	12.5
	256	100.0

C_{32}	192	52.8
H_{31}	31	8.5
O_4	32	9.0
Ag	108.1	29.7
	363.1	100.0

DISTILLATION OF MYRICINE.

The discovery of the cerotic acid rendered it evident that in order to obtain the products of distillation of myricine, and especially the acids, in a state of purity, it was necessary first to remove that body and to distil only the residue of the wax. I give the results of this experiment made with myricine. The first portions of the distillate consist almost entirely of acids, the latter of hydrocarbons. During the distillation a smell of butyric acid may be perceived. This, however, appeared to me to diminish when the boiling of the wax with alcohol had been very long continued. It is possible to effect nearly a complete separation of the acids and the hydrocarbons by distillation. It is, however, not advisable to proceed in this manner, but it is best, after boiling the distillate with water, to saponify the whole by potash. The soap may be removed by a syphon from the hydrocarbons which float on the surface.

PALMITIC ACID FROM THE DISTILLATION OF MYRICINE.

The acid, having been purified in the usual manner by washing out the baryta salt with ether, and the subsequent methods of purification, presents an appearance similar to the acids

obtained by saponification. By crystallization the melting-point may be raised to 62° C. :—

	CO_2.	HO.
I. 0.2592 grm. of this acid gave	0.7165	0.2931
II. 0.250 grm. of this acid gave	0.6865	0.27925
III. 0.2775 grm. of this acid gave	0.75925	0.311

These analyses correspond in 100 parts to :—

	I.	II.	III.
Carbon	75.39	74.89	74.61
Hydrogen	12.58	12.40	12.45
Oxygen	12.03	12.71	12.94
	100.00	100.00	100.00

The silver salt of this acid, prepared as before, gave the following results :—

I. 0.5006 grm. of the substance gave 0.1479 silver ;

II. 0.2295 grm. of another preparation gave 0.0685 silver ;

which correspond in 100 parts to :—

	I.	II.
Silver	29.54	29.84

	CO_2.	HO.
0.3505 grm. of the same salt gave	0.6873	0.2758

which gives in 100 paats :—

Carbon	53.47
Hydrogen	8.74
Oxygen and silver	37.79
	100.00

These numbers prove the identity of the acid from the distillation of myricine with that obtained from the saponification of that substance.

There are great difficulties in the way of obtaining even a sufficient quantity of this acid for the determination of its formula. To obtain even a very small portion of it of which the purity may be relied on, it is necessary to operate on a large quantity of the impure acid. For the preparation of this pure myricine is required, free from cerotic acid, which it is not easy to get in any quantity.

These difficulties have prevented me making any further experiments with this acid, the identity of which, however, with palmitic acid, as obtained by Frémy and Stenhouse from palm oil, and by Sthamer from Japan wax, is made out. I subjoin, for the sake of comparison, the silver determination of the silver salt of the palmitic acid as obtained by these chemists :—

	Frémy.*			Stenhouse.†	Sthamer.‡
Silver, p. c.	29.60	29.23	29.42	29.28	29.51

This acid appears also to be the same as the acid obtained by Varrentrapp§ from the oxidation of oleic acid by means of lime and potash, which also had the melting-point of 62° C. The silver determinations of this acid gave as the per centage of silver :—

29.27 29.45 29.13,

numbers identieal with my own.

[*To be continued.*]

ON THE QUANTITATIVE DETERMINATION OF ANTIMONY.

By Professor H. ROSE.

Dilute solutions of antimony, in which the amount of metal is to be determined, must not be eoneentrated by evaporation when they contain muriatic acid, as is almost always the case, because perchloride of antimony escapes with the vapours of the muriatic acid, especially when the liquid is concentrated at too high a temperature. The volatilization of the antimony cannot be prevented by an addition of sulphuric acid, but it may be pretty nearly so by nitric acid.

When the antimony is precipitated from such solutions by sulphuretted hydrogen, the sulphur or the antimony has to be estimated in the precipitated sulphuret, which corresponds to the degree of oxidation of the antimony. The author had previously stated that the reduction of the sulphuret of antimony is best effected in a porcelain crucible, into which hydrogen gas is conveyed by means of a porcelain tube. This process is far more easy of execution than the reduction in a bulb-tube.

The estimation of the sulphur in the sulphuret of antimony can be made in the usual manner, or by treating a weighed quantity of the sulphuret with muriatic acid. By this means only the perchloride of antimony ($SbCl_3$), corresponding in composition to antimonious acid, is formed, and the equivalent quantity of sulphur escapes in the form of sulphuretted hydrogen. The remainder of the sulphur separates in the solid form, which acquires, on long digestion with hot, highly concentrated muriatic acid, a pure yellow colour. It is collected on a weighed filter, washed first with water to which some muriatic and tartaric acid have been added, and finally with pure water. The weight of this sulphur indicates the amount of the sulphuret of antimony. According to this, the sulphosalts, which the highest sulphuret of antimony (SbS_5) forms with alkaline and other basic sulphurets, are treated directly with strong muriactic acid until the eliminated sulphur has a pure yellow colour, when it is weighed. But the antimony itself, as will be shown further on, can be estimated with perchloride of gold. In that case, however, the separated sulphur must be washed only with water and muriatic acid, and not with tartaric acid. 6.927 grms. of Schlippe's salt, $3NaS + SbS_5 + 18HO$, gave, according to this method, a residue of 0.449 grm. sulphur. According to theory, 0.455 ought to have been obtained. In another experiment, 10.049 grms. of Schlippe's salt gave 0.677 sulphur of a reddish colour, which left some sulphuret of antimony on combustion. Theory requires 0.660 grm. sulphur. This admixture of sulphuret of antimony can be avoided by the use of very strong muriatic acid.

Estimation of Antimonious Acid. — Antimonious acid (SbO_3) can be estimated in a similar manner to arsenious acid by means of a solution of the sodio or ammonio chloride of gold. The antimonious acid is dissolved in a very considerable excess of muriatic acid. After the liquids have been mixed, the whole is kept for several days in a gently heated place. When there is not a very large quantity of muriatic acid present, some antimonic acid separates with the reduced gold ; and this, once eliminated, can only be dissolved with great difficulty by a very large amount of muriatic acid. After several days the reduced gold is collected on a filter ; but the filtered liquid, containing the excess of perchloride of gold, is again set aside for some days, in order to see whether any further traces of gold separate. Some muriatic acid is added to the water used for washing. The reduced gold is ignited and weighed.

In case any antimonic acid has separated along with the reduced gold, it is removed by fusing the filter with its contents with nitrate and carbonate alkali, and the gold is weighed in the form of a regulus. Apparently borax cannot be used as a flux, as it furnished a red slag with loss of gold.

Separation of Antimony from Tin.—The author had previously described a method of separating these two metals, according to which the antimony was separated as antimoniate of soda by water from the solution of the tin in hydrate of soda. But, since the antimoniate of soda is not perfectly insoluble in water, this method does not furnish very accurate results. It is better, when separating antimoniate of soda from stannate of soda, to use dilute alcohol precisely of the strength given below.

In the case of an alloy, it is reduced to as fine a state as possible, and treated in a large beaker with pure nitric acid of 1.4 spec. grav. The excess of acid is expelled and the oxide dried. It is heated to a faint red, and fused in a silver crucible with a considerable excess of pure hydrate of soda, and the mass kept for some time in a liquid state. The cold mass is moistened with water, the crucible completely cleansed with water, and the whole poured into a large beaker, in which the sparingly soluble antimoniate of soda is allowed to deposit. The stannate of soda which contains the *a*-modification of the oxide of tin remains entirely dissolved in the water. So much alcohol of 0.83 spec. grav. is now added to the aqueous liquid that the relative volume to that of the water used is as 1 to 3. The whole is well mixed, and set aside to deposit. The stannate of soda remains dissolved in the dilute alcohol, whilst the antimoniate of soda is completely separated. The carbonate of soda which had been formed during the fusion in the melting is likewise held in solution by the dilute alcohol, as well as the excess of hydrate of soda. The liquid is perfectly clear, and is easily filtered ; the antimoniate of soda must then be washed with stronger spirit, consisting of equal volumes of water and alcohol of 0.83 ; and at last with still stronger spirit, consisting of 3 vols. alcohol of the above-mentioned strength, and 1 vol. water, until some of the filtered liquid, rendered acid with a little dilute sulphuric acid and mixed with a solution of sulphuretted hydrogen, no longer deposits, after long standing, any yellowish precipitate of sulphuret of tin. It is advisable to dissolve a very small quantity of carbonate of soda in the weak spirit used for the washing.

The alkaline liquid containing the stannate of soda in solution is now exposed to a gentle heat until the alcohol is expelled, diluted with water, supersaturated with sulphuric acid, precipitated with sulphuretted hydrogen, and the sulphuret of tin converted into oxide. The antimoniate of soda is treated in the manner described by the author in the separation of arsenic from antimony. On testing this method, M. Weber obtained :—

	Used.	Found.
Antimony	57.85	58.86
Tin	42.15	40.04

The use of a silver crucible cannot be avoided. Sometimes, owing to this, the precipitated sulphuret of tin is contaminated with a very slight trace of black sulphuret of silver.

Separation of Antimony from Tin and Arsenic.—The metals are oxidized with very strong nitric acid, the oxidized mass evaporated to dryness, and then fused in a silver crucible with from eight to nine times the amount of hydrate of soda. The fused mass is mixed with a little water, and treated with dilute alcohol by adding to the aqueous liquid, alcohol of 0.83 spec. grav. until its volume becomes to that of the water as 1 : 3. The whole is set aside for twenty-four hours, frequently agitated, the precipitate collected on a filter, the glass rinsed with spirit, and the precipitate of antimoniate of soda washed as above directed for the separation of antimony from tin. The antimoniate of soda is dissolved in a mixture of muriatic and tartaric acids, from which solution the antimony is precipitated by sulphuretted hydrogen.

It is scarcely necessary to drive off the alcohol by heat from the liquid separated from the antimoniate of soda. It is supersaturated with muriatic acid, and sulphuretted hydrogen passed through it, without previously separating the precipitated arseniate of tin. The whole is set aside until it scarcely smells of sulphuretted hydrogen, and the precipitate collected on a weighed filter. The filtered liquid is heated for some time, by which any sulphuretted hydrogen still present and the greater portion of the alcohol are expelled. It is then mixed with a solution of sulphurous acid, and again treated with sulphuretted hydrogen, when generally a further small quantity of sulphuret of arsenic is precipitated. This treatment with sulphurous acid is, however, not necessary if sulphuretted hydrogen is again passed immediately through the liquid separated from the sulphurets. The

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* Liebig's "Annalen," vol. xxxvi., p. 45. Silver determinations, V. VI. VII.

† Ibid, p. 52. The mean of five determinations closely agreeing. This acid melted at 60° C.

‡ Ibid, vol. xliii., p. 342. The mean of three determinations.

§ Ibid, vol. xxxv., p. 209.

small amount of sulphuret of arsenic which is precipitated in this case is always free from every trace of sulphuret of tin, and is kept separate, and only added to the sulphuret of arsenic obtained in the separation of the arsenic and tin. These two metals contained in the precipitate by sulphuretted hydrogen are separated by being heated in a current of sulphuretted hydrogen, when the sulphuret of arsenic is volatilized. The residual sulphuret of tin is converted into oxide, and the sublimed sulphuret of arsenic into arsenic acid. This method proved on examination to be absolutely accurate.

Separation of Antimonious Acid from Antimonic Acid.—These two acids may be quantitatively determined when they occur together in solution, by first determining in one portion of the solution the whole amount of antimony, and in the other the antimonius acid by means of perchloride of gold. This method, however, is limited in its application, for the solution must contain no nitric acid; the presence of muriatic or sulphuric acid is of no consequence. By means of the perchloride of gold the presence of any antimonious acid in antimonic acid can readily be detected, which is otherwise difficult. This applies especially to the combination of antimonic acid with oxide of antimony, SbO_3,SbO_5, which Berzelius formerly called antimonius acid, and which is left on calcining antimonic acid. To avoid any mistake, it may be as well to repeat here that at present the oxide SbO_3 is called oxide of antimony and antimonious acid, according as it occurs as base or acid; and that the former antimonious acid, SbO_4, is regarded, even in the fifth edition of Berzelius, as antimoniate of the oxide of antimony $= SbO_3 + SbO_5$, and no longer as a distinct oxide.

Now, heretofore, it was not easy to detect the lower oxide of antimony in the compound insoluble in muriatic acid; but, if it be fused in a silver crucible with hydrate of potash, the melted mass dissolves after cooling entirely in water. If it has not been fused too long, the alkaline solution, supersaturated with muriatic acid, reduces gold from a solution of the perchloride after some time, on the application of heat; whilst, when it has been fused too long with the hydrate of potash, the whole of the antimonious acid is oxidized into antimonic acid.

A solution of the nitrate of silver is a still more sensitive test for antimonious acid than the perchloride of gold. If, for instance, a solution of nitrate of silver is added to the solution of the antimoniate of the oxide of antimony, fused with hydrate of potash, a black precipitate is obtained, which is not soluble in ammonia, this dissolving only the precipitated oxide of silver and the antimoniate of silver. But when the antimoniate of the oxide of antimony has been kept fused for a considerable time with hydrate of potash, a black or brown precipitate is produced in the solution of the melted mass, which is entirely soluble in ammonia. This behaviour is explained from that of the different oxides. When, for instance, nitrate of silver is added to a solution of the antimonious acid in hydrate of potash, a deep black precipitate is obtained, which is not soluble in ammonia; but this removes oxide of silver from it, if any has been precipitated by the excess of potash. When ammonia is added first to a solution of antimonious acid in hydrate of potash (which produces no precipitate), and then nitrate of silver, only a slight black precipitate is obtained, which, however, increases with time. On the other hand, nitrate of silver causes in a solution of the antimoniate of potash a copious white, slightly yellowish precipitate of antimoniate of silver; and, when the solution contains free potash, it is coloured brown by separated oxide of silver. Both precipitates are entirely soluble in ammonia. The smallest trace of antimonious acid which might occur in it is left as a black precipitate when the mass is treated with ammonia.

The perchloride of gold likewise produces in solutions of antimonious acid in potash a black precipitate, which is not further altered by being heated. When a solution of perchloride of gold is added to one of antimoniate of potash, no precipitate is produced, even though it contained free alkali, provided the potash was free from organic acids. A slight black precipitate is formed by long standing.

Lastly, antimonious acid can be distinguished from antimonic acid in a muriatic solution by oxalic acid. This so completely precipitates the antimonious acid, after long standing, if too much muriatic acid be not present, that the filtered liquid contains not a trace. The precipitate does not appear immediately with a large addition of oxalic acid. From a solution of antimonic acid in muriatic acid, oxalic acid precipitates only a few flakes after long standing; tartaric acid prevents entirely, or nearly so, the precipitation of the antimonious acid by oxalic acid, as in the case of tartar emetic. Perchloride of gold is very slowly reduced in the cold by tartar emetic; the same is the case with a solution of silver. When the solution of tartar emetic is mixed with potash, and then with nitrate of silver, a black precipitate, insoluble in ammonia, is formed.—*Poggendorff's Annalen*, lxxvii., p. 110, and *Chem. Gaz.*

ON THE FERMENTATION OF THE MALATE OF LIME.

By Professor J. LIEBIG.

As it is probable that some chemists may have procured during the present season a supply of malate of lime for the preparation of succinic acid, it may be useful to add to the information previously communicated some further experience respecting the fermentation of the malate of lime.

From the juice of the berries of the mountain ash, which had been neutralized with milk of lime and then mixed with beer yeast, there separated, after ten days' standing at the ordinary temperature, colourless crystals of pure succinate of lime several lines in length; they were coated with a fine coloured powder, which consisted of carbonate of lime. I have observed that the amount of succinic acid is greater the more slowly and quietly the fermentation is conducted. It is, therefore, of importance that the temperature during the fermentation, and the quantity of yeast or putrid cheese which is added, should not exceed a certain limit. 125 cub. centim. of yeast to 1 lb. of dry malate of lime and 6 lbs. of water proved to be a very good proportion. The disengagement of hydrogen is decidedly injurious; it indicates another process of fermentation, in which no succinic acid is formed, or that which has been formed is destroyed. In one case, in which 19 lbs. of malate of lime were fermented with twice the usual quantity of cheese, on the seventh day the fermentation became so violent that the mass overflowed from the great disengagement of gas. Nearly the half of this gas proved to be hydrogen. In this experiment not more than 1 lb. of succinic acid was obtained from this large quantity of malate of lime.

The disappearance of the acetic acid in this experiment was remarkable; the mother ley contained in its stead a quantity of butyric acid. From 24 to 30 oz. of oily butyric acid (which, however, was not free from acetic acid) were obtained from the mother liquor. There is at the same time formed another volatile product, of an oily ethereal nature, which is procured by distilling the mother liquor containing the lime salts. It is colourless, readily soluble in water, and has a powerful agreeable odour of apples. It is separated from water by carbonate of potash and by chloride of calcium (of which it dissolves a considerable quantity in the anhydrous state). It is one of the so-called fermentoles, of which several, as first suspected by Berzelius, are probably compounds similar to alcohol or the aldehydes.

The formation of the succinic acid is explained in the following manner:—

Six equivs. malic acid take up the elements of 3 equivs. water, and produce 4 equivs. succinic acid, 4 equivs. carbonic acid, and 1 equiv. acetic acid:—

$$\left.\begin{array}{l}6 \text{ eqs. malic acid, } C_{24}H_{12}O_{24} \ldots\ldots \\ 3 \text{ eqs. water, } H_3O_3\end{array}\right\} = \left\{\begin{array}{l}4 \text{ eqs. succinic acid, } C_{16}H_{12}O_{16}. \\ 4 \text{ eqs. carbonic acid, } C_4O_8. \\ 1 \text{ equiv. acetic acid, } C_4H_3O_3.\end{array}\right.$$

If butyric acid is produced directly from malic acid, there should be disengaged on the whole carbonic acid and hydrogen in the proportion by volume of 1 : 2; but, as at least 3 equivs. of the carbonic acid are retained by the lime, the proportion of carbonic acid and hydrogen obtained should be as 10 : 8 or as 5 : 4 volumes.

If we imagine butyric acid to be produced from succinic acid, the carbonic acid and hydrogen disengaged should be in the proportion of 2 : 1.

$$\left.\begin{array}{l}4 \text{ eqs. malic acid} \ldots \\ \text{Add to which } H_4O_4\end{array}\right\} C_{16}H_8O_{16} = \left\{\begin{array}{ll}C_8H_8O_4, & \text{butyric} \\ H_4 & \text{acid.} \\ C_8 \quad O_{16} &\end{array}\right.$$

$$C_{16}H_{12}O_{20} = C_{16}H_{12}O_{20}$$

Of the 8 equivs. carbonic acid, 3 are retained by the lime.

$$\left.\begin{array}{l}3 \text{ equivs. succinic acid, } \ldots\ldots\end{array}\right\} C_{12}H_9O_{12} = \left\{\begin{array}{ll}C_8H_8O_4, & \text{butyric} \\ H & \text{acid.} \\ C_4 \quad O_8 &\end{array}\right.$$

Of the 4 equivs. carbonic acid, 2 equivs. are retained by the lime.

The following proportions of hydrogen and carbonic acid were obtained at different periods of the fermentation (accompanied by evolution of hydrogen):—

150 H : 169 CO_2 = 4 : 4½
140 H : 140 CO_2 = 4 : 4
108 H : 186 CO_2 = 4 : 7
120 H : 220 CO_2 = 4 : 7½
111 H : 221 CO_2 = 4 : 8

From these relations it may be admitted that the butyric acid is produced both from the malic and the succinic acids, which would explain the decrease in the amount of the latter.

The following analyses of the products of this process of fermentation were made by Mr. Halerow:—

The Acetate of Silver furnished:—

Carbon	14.3	4	=	14.4
Hydrogen	1.9	3		1.8
Oxygen	..	3		14.3
Oxide of silver..	69.3	1		69.5

The Butyric Acid gave:—

Carbon	54.1	3	=	54.5
Hydrogen	9.2	3		9.1
Oxygen	..	4		36.4

Liebig's Annalen, June, 1849.

Royal College of Surgeons.—The following gentlemen, having undergone the necessary examinations for the diploma, were admitted members of the college at the meeting of the court of examiners on the 5th inst., being the first meeting this session:—Messrs. George John Hinnell, Tamworth; Henry Merrill Williamson, Chapel-en-le-Frith, Derbyshire; Richard Skinner Henning, East Brent, Somersetshire; John King Maconehy, Dublin; Henry Tregelles Fox, Dunmow, Essex; John Strean Armstrong, Belfast; James Denholm Pridie, Stockton-on-Tees, Durham; John Horsley White, Wolverhampton, Staffordshire; Charles Nathaniel M'Caull, Dublin; William Henry Tinney, Ottery St. Mary, Devon; and William Cowen, Stokestown, county of Roscommon.

Apothecaries'-hall.—Names of gentlemen who passed their examination in the science and practice of medicine, and received certificates to practise, on Thursday, October 4, 1849:—Joseph Skelding, Bridgnorth; Robert Hamilton, Ipswich; George Paton, Wetherby; John Anderson, London; William Robert Stewart, London; Clement Madely Smith, Horncastle.

Hamelin's Mastic Cement.—Mix fifty parts of siliceous sand, fifty parts of lime marl, or pulverized Portland or Bath stone, and eight parts of litharge. When the cement is used it is to be ground up with linseed oil.

STATEMENT IN CONTINUATION OF THE ONE PUBLISHED IN THE CHEMICAL TIMES OF OCT. 6, 1849, SHOWING THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE AIR FROM SEPT. 30 TO OCT. 6 INCLUSIVE, AS INDICATED BY THE EVAPORATION OF WATER FROM TWO COPPER VESSELS OR SCALES, ONE INSULATED AND THE OTHER NOT. ALSO THE READING OF THE BAROMETER, THERMOMETER, DIRECTION OF WIND, AND GENERAL STATE OF THE WEATHER.

Sept. and Oct., 1849.	Barometer.		Therm.		Scales.				Wind.		General State of Weather.
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Insulated	Non-Insulated	Morning.	Evening.	
30	29.23	29.23	61	58	..	20 N.	..	20	SW.	W.	Heavy rain from 12 to 8 A.M., and from 11 A.M. to 10 P.M.
1	29.45	29.60	54	52	..	20 N.	..	20	SE.	NE.	Overcast and gloomy all day.
2	29.67	29.73	51	49	10 N.	..	..	10	NE.	N.	Ditto - - ditto - - and fog in the morning.
3	29.50	29.30	49	56	..	..	..	..	SE.	SW.	Rain all day, and rapid condensation of moisture on interior of walls of buildings.
4	29.03	29.45	54	59	..	10 N.	..	10	SW..	NW.	Rain from 10 P.M. to 7 A.M.; showers during the day, and heavy rain at night.
5	29.70	29.68	45	49	10 I.	5 I.	15	..	W.	SW.	Fine all day; overcast in the evening.
6	29.75	29.57	47	48	5 N.	10 N.	..	15	SW.	SE.	Fine till 5 P.M.; rain rest of the day and the evening.

It will be observed that on the three first days of the week the barometer and scales indicated different conditions in the atmosphere, a circumstance of no unusual occurrence, the scales generally proving correct, the fluctuations in the mercury being, in fact, frequently altogether unaccountable.

Westminster-road, Oct. 9, 1849.

Franklin Coxworthy, Author of "Electrical Condition," &c.

FRANKLIN COXWORTHY'S DISCOVERIES IN NATURAL PHILOSOPHY.

[*Continued from page* 211.]

We did not, in introducing to the consideration of our readers Sir Humphry Davy's theory in exposition of the phenomena of heat, as contradistinguished from the opinions generally entertained by men of science, contemplate any further investigation of it; because we deemed it to be in no respect necessary to the further elucidation of those principles in philosophy, which, if not explaining the abstruser portions of the subject, will so far simplify them as to render intelligible the more immediate phenomena of heat. In our present strictures, therefore, we shall confine our remarks to the generally received doctrine that heat is material. Long before electricity had engaged the attention of the philosophic inquirer, he had become familiar with all the external characters of heat. And when chemistry was pursued as a science, and it was found that the electric spark, in common with flame, would ignite the explosive gases, the mind naturally associated electricity with heat. Nor, without that sceptical mode of examination with which original minds refuse to take anything for granted, could it well be otherwise; for the great Franklin had already shown that lightning, which set on fire combustible and explosive compounds, was identical with the electric spark; and cold had always been regarded as the simple absence of heat. These assumptions have, consequently, been handed down to posterity from generation to generation, the tutor inculcating, the pupil receiving, apparently prepared facts, and propagating their supposed veracity, as the unquestionable emanations of truth. Nothing could be more easy than this; and, on the contrary, scarcely anything more embarrassing than the raising of opposing questions by a mind which the very tendency of its previous education might be said to have denaturalized.

Herein was Franklin Coxworthy's main advantage. He brought to the investigation a mind devoid of any preassumptions, unprejudiced, unhackneyed, and ready to receive direct and undistorted impressions of the phenomena of nature. So that, when he observed the flash of lightning proceeding from the clouds to the earth, he conceived the idea that the fluid, being generated by decrystallizing snow, and collected in an atmosphere intensely cold, could not be hot; and that, therefore, its action on matter in the production of combustion must be referable to some other cause than heat,—a conclusion the corroboration of which he found in the fact that no impression of heat is conveyed to the sense when sparks are drawn from an electrical machine by the finger. And, if any further proof were requisite, it is afforded by the equally cognizant fact that both cold and electricity rapidly induce crystallization.

This, then, brings us to a further stage in the series of propositions upon which he takes his stand as an innovator upon previously accepted opinions:—

Old Doctrine.	*New Doctrine.*
Heat, light, and electricity are identical.	Heat and cold are mere electrical conditions; cold, light, and electricity being identical.

Reasoning, as we have premised, and applying his deductions to a phenomenon of nature with which we are all familiar, the freezing of water, Franklin Coxworthy arrived at the conclusion that the operation was strictly analogous to the crystallization of salt; both being solely referable to electricity. Hence he conceived that, if water, during crystallization, absorbed electricity, ice ought freely to yield electricity during decrystallization. And this he demonstrated by a novel and ingenious experiment, which we cannot do better than describe in his own words:—

"Having made a boiling solution of alum, I placed it in an oven of about the temperature of 200° to cool or settle, and put into the oven, with the jug containing the solution, two tumblers in every respect of the same construction, that they might be raised to the temperature of the solution. These preliminary arrangements having been made, an equal amount of the solution was poured into each tumbler, previously insulated and suspended over the oven in a temperature of 80°. At the other end of the room was placed a freezing mixture of ice and salt, also insulated, having in the centre of it a copper coil, which copper coil was connected with one of the tumblers by a fine copper wire; the length of the wire, which was broken into joints, connecting the freezing mixture and solution being ten feet. About ten minutes after the connection was established, a stream of beautiful crystals fell from the top of the solution to the bottom of the glass, although no action whatever was apparent in the other solution. After the operation had gone on some time, and the solution in the other glass began to crystallize at the bottom of the glass, two other tumblers were placed upon the table, and the menstruum of the two insulated tumblers thrown into them; that of the connected solution immediately crystallized all over the interior of the glass in an aborescent form, whilst the other crystallized slowly at the bottom of the glass, affording evidence not only of the influence exercised by the freezing mixture while connected, but also of its having imparted to the solution itself altogether a different character to that which it originally possessed."

Now, we cannot comprehend what more conclusive proof can be required. Herein, as in other instances adduced by us in his favour, inductive reasoning is supported by practical experiment of the simplest nature; unerring in effect; and which could not possibly be attended by the same results if the pre-existing doctrine were correct.

We might pursue this subject much further, but it would involve the collateral examination of other propositions to an extent beyond the limit that can here be afforded. Of these, however, the "attraction of cohesion," and the "attraction of gravitation," being inseparable, we shall treat in our next; and we shall then be in a position more freely to discuss the subject of "heat." And here we must not omit the opportunity of remarking, that in our previous papers we have felt the disadvantage under which we have unavoidably laboured, in endeavouring to keep as separately as possible the different propositions submitted to examination. With the scientific world it may be said to have been the effort of ages to blend the sciences, although no two of them have yet been successfully connected. Our principal difficulty has consisted in keeping them apart. S.

COW'S MILK CONTAINING BLOOD.

By Prof. R. F. MARCHAND.

The author examined the milk of a cow which several times after calving had yielded a milk resembling brown syrup more than the natural fluid. The animal exhibited no sign of disease. The author examined the first milk, and then fresh specimens every two days.

The first was of a blackish-brown colour, and even after standing for a considerable time did not yield a white scum. It was so tenacious that it could be hardly made to flow from one vessel into the other. It had the odour of milk; was insipid, but like milk. Its specific gravity at 59° F. was 1.0222, whilst that of normal cow's milk is usually 1.02. On microscopic examination a large number, but not the normal quantity, of milk globules was perceived. In addition to these, it also contained a large number of well-developed granular corpuscles, which, as is well known, are peculiar to the colostrum. Numerous fibrinous bundles and flakes also existed in it, but no trace of blood-corpuscles could be detected. On analysis it

was found that this milk contained the components of the blood in addition to all those of normal milk. When heated it coagulated completely, like albumen, or rather like blood. The same occurred on the addition of spirit. This precipitate had exactly the appearance of that yielded by blood under the same circumstances. The alcoholic solution, which contained fat, was examined for sugar by the copper test, and a large quantity was discovered. The precipitate produced by alcohol was digested with alcoholic sulphuric acid; it yielded a brownish-red clear solution, but was itself converted into a grey crumbly mass. The brown solution exhibited the well-known reactions of a similar solution of the red colouring matter of the blood. Brown flakes were precipitated by ammonia; these yielded a brownish-red powder, which, when dried and incinerated, gave about 9 per cent. of peroxide of iron. The milk yielded 29.24 per cent. of solid residue. This consisted of:—

Fatty matter	1.75
Sugar	5.14
Caseine	2.20
Albumen	15.00
Fibrine	0.20
Hæmatine, &c.	4.95
	29.24
Water	70.76

The specimens which were subsequently examined gradually diminished in specific gravity, becoming at the same time clearer, yielding a creamy scum when set aside, and exhibiting fewer of the fibrinous coagula and granular corpuscles; the amount of albumen simultaneously diminishing until the twenty-fourth day, when the liquid had acquired the characters of normal milk, except that it still contained a few granular cells. No blood corpuscles could be detected throughout the course of this investigation, although the above facts showed that it contained blood.—*Journ. für Prakt. Chem.*, xlvii., p. 130—134.

REPORT OF THE COMMISSIONER OF PATENTS OF THE UNITED STATES ON EXPLOSIONS OF STEAM-BOILERS, DECEMBER 30, 1848.

[*Continued from page* 226.]

Boilers with L flues are liable to a similar source of danger. The portion of the flue above the level of the water in the boiler is exposed to the heat of the fire while not in contact with water. Its tenacity is thus diminished, and it is rendered likely to yield to the pressure within the boiler, and collapse.

Boilers with steam chimneys are still employed for the sake of the advantage of having the steam surcharged with heat, so as to prevent condensation in the steam-pipe and cylinder. They differ from those last mentioned only in the fact that the exposure is greater. The source of danger is the same. Two explosions of boilers of this kind, examined by Mr. Ewbank, were identical in the phenomena exhibited. The vertical arm of the L flue, in both cases, was collapsed in the same way, showing that the defect is inherent in the form. The Franklin Committee recommend the discontinuance of the use of both of these forms.

They also discourage the formation of small spaces to contain water and be surrounded by fire. Such spaces are liable to accumulate deposites, and to become unduly heated by the water being forced out of them by the formation of steam, as in the case of small tubes.

Boilers of irregular forms are necessarily weak; the tendency of a force acting within them equally in all directions would be to bring them to a cylindrical or spherical form.*

The use of cast iron as a material for boilers is believed to have been entirely abandoned; but five cases are given in which this material was employed for the heads of boilers which exploded; and its use for boiler heads is still, to some extent, persevered in, notwithstanding the warning voice which science and experience have united to raise against it. The question of the safety of the employment of this material for boilers came up before the committee of the British Parliament who were charged with the investigation of the causes of explosions in the year 1817; and the testimony against its use, even at that early period in the history of steam navigation, was unequivocal.* The use of boilers, or boiler tubes of cast iron, was positively prohibited by the French Government in 1828.† The operation of casting, however, well performed, is an uncertain process; and the defects of structure incident to it being concealed from view lead to a false impression of the real strength of the article cast. But, perhaps, a more pregnant source of danger in the case of cast-iron heads lies in the unequal rate of its expansion as compared with the wrought metal to which it is attached, rendering it constantly liable to fracture or cracking. Mr. Cist, in his valuable communication, mentions a case in which the cast-iron heads of a range of seven boilers were all found in pieces when the boilers were taken apart at the head, and remarks that these heads are generally found in this condition when they are removed from the boilers. The history of six boilers of this kind, which were made at Shippingport, affords a striking proof of the danger arising from the use of such heads. Of these boilers one was placed on the Car of Commerce, and, although the only new boiler on the boat, it was the only one that gave way. Its afterhead was blown out, and the boiler was projected several hundred feet over the bows of the boat into the river. The five others were put into the Atlas, and exploded the same season in a similar manner. The case of the Helen M'Gregor was of the same character. The head of that boat's boiler blew out and broke into numerous small fragments, killing several persons and wounding others.‡ Every consideration, then, of prudence, and even of common humanity, would seem to dictate the immediate and total abandonment of cast iron as a material for boiler-heads.

The question of the relative strength of materials with direct reference to their use for steam-boilers has been made the subject of a series of elaborate experiments by a sub-committee of the Franklin Institute, of which Professor Johnson was chairman, in whose able report the subject is considered in a light entirely new. In these inquiries the element of temperature in its relation to tenacity has, it is believed, been for the first time fully considered. The practical value of the results of this protracted and laborious research has been admitted by men of science throughout the world. It would be impossible here to give, within any reasonable limits, an abstract of these results; some of the general conclusions to be drawn from them will alone be stated.

The question of the relative merits of copper and iron as materials for steam-boilers is directly affected by the experiments of this committee. The advantages of the former material are its superior durability, and its high-conducting power, besides the value of the old materials; but, on the other hand, it is found that an increase of temperature is attended invariably with a diminution of strength, the squares of the diminution of strength varying as the cubes of the temperatures.§ Between the freezing and boiling points it parts with 5 per cent. of its strength; at 550° Fahr. it loses about one quarter; at 850°, one half; and at 1300° it becomes a viscid, granular, soft, incohesive substance, entirely destitute of tenacity, though it does not absolutely melt under 2000°.

Iron, on the contrary, presents a state of fact directly the reverse, and apparently anomalous; it increases in tenacity with the increase of temperature until it reaches its maximum strength at about 570°, at which temperature it is 16 per cent. stronger than when cold. When this temperature is exceeded, however, its strength rapidly diminishes. An explanation of this effect will be given hereafter. The different modes of manufacture also were found materially to affect the tenacity of iron. Repeated piling and welding is attended with a great increase of strength. Pig iron of a white fracture produced the most cohesive bars; lively grey, dead grey, and mottled metal produce bars inferior to the first by from 1 to 5 per cent.; and a mixture of all the kinds gave the most unfavourable result, being from 5 to 10 per cent. below the first in tenacity. The difference between the strength of boiler-plate cut lengthwise and that cut across was found to be about 6 per cent. in favour of the longitudinal over the cross cut. Riveting diminished the strength about one third. Long use and exposure were attended with great loss of strength. Overheating also produced a permanent reduction of tenacity about one third. The thinning of boiler-plates by pressure was also made a oubject of careful inquiry. It was found to amount in iron to about 16½ per cent. of the whole area, to take place less in heated than in cold specimens, and to be attended with great weakening of the plate. Fractures at high temperatures took place suddenly, and the section was smooth, flat, and tapering. An important practical result of this investigation is, that boiler iron cannot safely be exposed to a pressure greater than one fifth of its standard maximum cohesion; 12,500 lbs. of extension on each square inch of cohesive action may be assigned as the safe working strain of iron boilers.

A result which affords an explanation of the apparent anomaly with regard to the tenacity of iron before noticed grew out of a minute investigation of the same subject by Professor Johnson. It is, that iron which has been subjected to a tensile force, while heated to a temperature not exceeding 500° or 600° Fahr. (that force being equal to the whole tenacity of the metal before heating), will, when again cooled down to the ordinary temperature of the air, be found stronger not only than it was before heating and straining, but also stronger than it was while hot.* This shows that the increase of tenacity is not due to the presence of heat, as it still remains after the metal is cooled, but probably to some molecular change in the iron which the increase of temperature allows the tension to produce. This principle has been made the foundation of inventions for the improvement of the manufacture of iron, and of articles formed therefrom (such as chains, connecting-rods, &c.), and has relation to steam-boilers not less than other articles formed of iron, inasmuch as the strain put upon an iron boiler at a high temperature is proved not so to weaken it as to render it afterwards liable to rupture by a less force. The same experiments prove that when the temperatures above mentioned are much surpassed iron begins rapidly to lose not only the acquired additional strength, but also that which it possesses in the cold state, as it came from the hammer or the rolls.

In another respect the influence of heat upon iron within the range of temperature above stated is found to be important. In a report on this subject made to the bureau of construction, equipment, and repairs of the Navy Department, under date of September 4, 1843, the interesting fact is presented that a bar or bolt of iron of good quality, when strained lengthwise with such a force as to break it while cold, will, in general, be elongated before it actually breaks by about 16½ per cent. of its original length; but that the same iron when strained at a high temperature not exceeding 400°, and with a force equal to that which broke it in the cold state, will only be elongated 5¾ per cent., or about one

* General Report, Franklin Committee, p. 34.

* Parliament Report, 1817, vol. iv., Galloway's, Collinge's Testimony, *et. al.*

† See Circular to Prefects, August 1, 1828; "Frank. Jour.," vol. viii., p. 33.

‡ "Franklin Journal," vol. viii., p. 308.

§ "Rep. on Strength of Materials," p. 75.

* "Amer. Journal Science" (new series), vol. i., p. 299.

third as much as when the same force had been applied to it cold. This principle applied to the steam-boiler shows that there is no danger of reducing the thickness of the sheet of iron by such a force of steam as would place the boiler under the same strain as it would bear when cold.

It is believed that the republication of the whole investigation of the committee of the Franklin Institute, and its wide dissemination among the practical engineers of our country, would be an important service to the cause of public safety.

When the material used for boilers is the best in its general kind it may still be individually defective in quality. Mr. Cist expresses the opinion that much of the boiler iron of the west is made from inferior ore, deficient in fibre and tenacity. The case of the Louis Whetzel is mentioned as an illustration, in which the boilers gave way on the first trip under ordinary pressure, and while containing a sufficient supply of water to preclude the idea of their being softened by heat. The repeated recommendation of a test to be enforced by law of the quality of iron used for boilers indicates the existence of a general conviction that the quality employed for this purpose is often dangerously inferior. A number of instances are given in which the boilers or flues were deficient in thickness. Such were the cases of the Clyde, the B. Gilman, the Persian, Oronoco, Superior, Missouri, Alton, Majestic, and others; in all which cases there appears to have been no deficiency of water in the boilers. The steam-boat Cutter is cited as a remarkable instance of the danger arising from deficient thickness of iron. In this case the boat was careened to one side—a position always involving danger to the upper boiler from a deficiency of water; yet the lower flue (which proved to be the thinnest), although completely submerged, collapsed, while the thicker flues on the other side, though unduly heated, did not give way.

Bad workmanship is, doubtless, a frequent source of accident, though, from the nature of the case, full information on this point cannot readily be obtained. Most of the cases in which this cause is distinctly assigned consist rather of omissions of important parts than of defective work. With reference to repairs, however, there is direct evidence to show that they are frequently done in great haste, and without a due regard to safety. One case is given in which an iron boiler was patched with copper rivets; and one in which repairs were made by unpractised apprentice boys, because good workmen could not be immediately obtained.

The fourth cause of explosions given by the report of the Franklin Institute is the "carelessness and ignorance of those entrusted with the management of the engine;" and this is that which, in the deliberate opinion of the undersigned, is operative in the great majority of these fatal occurrences. The explosions which have been distinctly attributed to this cause amount to the large proportion of $32\frac{1}{2}$ per cent. of the whole number of those in which the cause is given. Yet even this proportion, large as it is, does not give a fair estimate of the extent to which this cause is operative; for the existence of the other causes can also be traced, in a great majority of cases, to criminal neglect, ignorance, or carelessness in some quarter. "Undue pressure within a boiler," gradually increased until it exceed the limit of the estimated tenacity of the boiler (a point very far above its proper working pressure), while at the same time the supply of water is sufficient, could scarcely occur otherwise than by neglect in allowing the safety-valve to become corroded on its seat, or by intentionally overloading it. "The presence of unduly-heated metal within a boiler" is attributable to a deficient supply of water, which allows some portion of metal which is in contact with the fire to become uncovered; or to deposits, which operate by interposing a non-conducting substance between the metal and the water, thus allowing the heat to accumulate in the former, and thereby to reduce its tenacity. Now, the remedies for both these evils are in the hands of the engineer, who cannot fail to apply them, unless through culpable negligence. "The defective construction of the boiler and its appendages" is the result of unfaithfulness in the manufacturer, induced, perhaps, by the false economy of the owners with whom he contracts.

It thus appears that all the causes of explosions which have been assigned by the distinguished scientific authority so often cited may be resolved, without unfairness, into this one—the carelessness or ignorance of those entrusted with the management or manufacture of the boiler. The whole of this blame does not, however, justly rest upon the engineers in all cases; for there is too much reason to belive that they are often interfered with, in the most unwarrantable manner, in the performance of their duties, by the captains who employ them, and are forced to pursue a course condemned by their judgment and conscience, through fear of losing their situations. The view here taken of the frightful extent to which this cause of explosions operates is not only a legitimate inference from the statistics given, but is directly borne out by the testimony of the numerous intelligent and practical men who have furnished the office with their opinions in detail. Upon this view are based the recommendations to be hereafter made.

The causes of boiler explosions having thus been briefly considered, the remedies which have thus far been proposed suggest themselves as the next topic for consideration. These are either mechanical or legal.*

The various contrivances to prevent explosions by mechanical means are known as the "safety apparatus" of the engine. These contrivances have been well classified as being, first, such as merely indicate danger without relieving it; second, such as are brought into action and relieve the boiler from excess of steam by the force of pressure alone, or by temperature independent of pressure; third, such as are brought into action by deficiency of water, combined with pressure; fourth, such as supply water without indicating either pressure or temperature.

To the first class belong the common syphon-gauge of low-pressure boilers, the manometer for high-pressure boilers, the glass water-gauge, the compound water-gauge or altometer of Mr. Quinby, his alarm altometer and vaporimeter, the percussion water-gauge of Worthington and Baker, together with the common trycocks, and all those instruments which depend on the opening of small valves to sound an alarm.

In the second class may be placed the common safety-valve, the safety-guard of Mr. Evans, the fusible discs used in France, and the expansion-guard of Mr. Wright.

In the third class are to be found the safety apparatus of Mr. Raub, the hydrostatic-valve of Mr. Duff, and the interior safety-valve of Mr. Easton.

To the fourth class belong the ordinary force-pump, the subsidiary pumping-engine used in many steam-boats, and the self-acting pumping-engine of Mr. Barnum.*

The records of the Patent-office show that no small share of the ingenuity of inventors has been directed to the invention or improvement of safety apparatus for steam-boilers; and yet it could not be said with truth that any of these contrivances have fully met the demands of the public for a perfect safeguard against the fatal explosions so frequently occurring, especially on our western waters. An invention which should meet these demands ought to be prompt, certain, and irresistible in action under all situations and temperatures; it should be liable to no casual impediment, and placed beyond the reach of improper interference; should indicate the approach as well as the presence of danger, of which it should give some unequivocal warning; should show the degree of heat and consequent pressure on the boiler from boiling to the highest permissible point, and should give immediate notice of a deficiency of water. It should exhibit its indications in a form obvious and striking; should be self-adjusting, and readily adjustible, simple, and enduring, and not too expensive in its construction. To go into minute detail with reference to the various inventions which are now rivals in the contest for public favour, or to enter into any discussion of their relative merits, would comport neither with the objects of this report, nor with the strict impartiality which inventors have a right to demand from this office. A general notice of them is all that will be attempted.

The common syphon-gauge or dyanometer is a tube of iron or glass of equal calibre throughout, open at both ends, and bent in the shape of a U, one limb being longer than the other, and the extremity of the shorter limb placed within the boiler. Into this tube mercury is introduced, and stands at an equal height in both limbs. When the pressure within the boiler is just equal to that of the atmosphere, the height of the mercury remains unchanged; but when the pressure within exceeds that of the atmosphere without, the mercury rises in the outer limb of the tube to a height proportioned to the difference—each inch of rise indicating an increased pressure within, equal to about 1 lb. per square inch. When the tube is of iron, a float placed on the surface of the mercury in the outer limb is connected with a rod which passes out at the top, and indicates the rise and fall on an attached scale. This instrument answers admirably as an indicator of pressure in low-pressure engines; but in those on the high-pressure principle, as about fifteen inches must be added to its length for each additional atmosphere of pressure, the great height to which the outer limb has to be carried renders its application inconvenient; nor is the serpentine form less objectionable. It, moreover, merely indicates pressure without giving an alarm, and is, therefore, no safeguard against explosion—except as offering to the eye of an attentive engineer an index of the existing force of the steam. Its bore is too small to permit it to act as an efficient means of escape for the steam, should the mercury be blown out by the excess of pressure within. While, therefore, it is a valuable appendage to a boiler as an indicator of pressure, it cannot be considered as, of itself, a reliable security against danger.

The closed gauge or manometer is similar in general form to that just described, but its outer limb encloses air, and is not open to the external atmosphere. The air in this limb is condensed, and the indication of pressure within the boiler is given by the varying volume of the air in the outer limb; the tube being transparent and graduated to atmospheres. The objections made to this gauge by the Franklin Committee are, that it requires great nicety in its construction and graduation, and a correction for the temperature of the air enclosed in it. These objections were of sufficient weight to induce the declaration that no gauge applicable to it (the high-pressure boiler) has yet been brought into use,* a fact to which the attention of inventors should be called, as opening a field for the profitable and useful exercise of their ingenuity.

The glass water-gauge is a thick tube of well-annealed glass connected with the boiler by two lateral pipes—one of which passes in below and the other above the proper level of the water. These pipes are provided with cocks, by which connection between the tube and the boiler can be made at pleasure. The object of this apparatus is, to ascertain at a glance the true level of the water in the boiler. The objections which have been urged to its use are, that the unequal expansion of the glass and the metal with which it is connected renders the

* Sen. Doc. 405, 28th Cong., 1st session, p. 3. Report of Profs. Johnson and Jones to Secretary of Navy, June, 1844.

* General Report, p. 8; also Report on Experiments, "Frank Jour.," vol. xvii., p. 3.

former liable to fracture ; that it is also liable to fracture from shoeks, and by sudden variations of temperature. To obviate these difficulties, it was proposed to pass the ends of the tube into stuffing-boxes, and to make them of well-annealed glass of considerable thiekness. The use of green glass obviates the difficulty of the glass clouding, when high steam is used, from the action of the steam on the alkali contained in the substance of the glass. The indication by this instrument of the height of the water within the boiler was found to be aecurate. Even when foaming oeeurred by relief of pressure within the boiler, and when the gauge-eoeks could not be trusted, the oscillations in the tube did not amount to half an ineh, and on closing the eonneeting-pipes the water in the tube beeame tranquil at the mean level of its oseillations.* The use of this gauge is highly recommended by the Franklin Committee.†

The vaporimeter of Mr. Quinby is an instrument intended to indicate the temperature of the steam within the boiler by the expansion and contraetion of mereury eontained in a large metallie tube inserted into the boiler above the water level. It is, in fact, a large metallic thermometer, the bulb of whieh is the large tube within the boiler, and its stem the small perpendicular tube on the outside of it. On the mercury in this outer tube is plaeed a float eonneeted with a rod, the varying height of whieh indicates the temperature of the steam, and its consequent elastieity. Its advantages are its little liability to injury from aeeident, and the ease with whieh its indications are read off, owing to the large size of the degrees marked upon its scale. It is, however, a mere indieator of temperature, and the consequent pressure, dependent for its utility upon the watchfulness of the engineer, and, therefore, least useful where danger, from his negleet, is greatest. Its cost is also a serious objection.‡

The alarm altometer of Mr. Quinby eonsists of a bueket-float, enelosed in a cylinder eonnected with the boiler by lateral pipes entering below and above the water line, so that the water in the eylinder and in the boiler shall always stand at the same height. The fall of the float opens a small valve, to whieh a steam-whistle is attaehed. The operation of this instrument, as reported by Messrs. Johnson and Jones, was not satisfactory. The alarm was feeble, owing to the smallness of the valve, yet its size, if increased, would enable the pressure upon it by highly elastic steam to counteract the weight of the float, and thus prevent any action. It is also liable to obstruction from deposits, is too eomplex in its construetion, and attains no object that could not be secured by a float within the boiler.§

Another altometer has been invented by Mr. Quinby, which is a complex modification of the glass tube-gauge, identieal in principle, and offering no advantage over it. It is heavier than the common gauge, more liable to fracture, more difficult to repair, requires greater precision in its workmanship, and is consequently very eostly.‖

The percussion water-gauge of Worthington and Baker is an ingenious contrivance for aseertaining the height of water in the boiler by the percussive aetion of a horizontal flat surfaee brought suddenly into contact with the surface of the water the height of whieh is to be gauged. It consists of a tube so conneeted with the boiler as that the water it eontains shall stand at the same height as that in the boiler. In this tube is a piston whieh can be brought into sudden eontact with the surface of the water by means of a projecting arm, under the control of the engineer. When it is desired to aseertain the height of the water, the engineer, by means of the arm mentioned, pushes down the piston until it strikes the water. The slight shock or eonеussion produced by the contact is readily felt by the hand of the engineer, and the position of the arm at the time gives, on an attached seale, the desired information. This instrument is said to operate well, but it depends entirely upon the attention of the engineer, and neither indieates the approaeh of danger nor relieves it. In the case of recklessness or neglect it would be of no service.

The eommon trycocks are two or more tubes entering the boiler at short distances above and below the due water line. When upon turning the cocks steam issues from the upper and water from the lower ones, the water in the boiler is supposed to be at its proper height. The indications of these instruments are, at least, extremely rude. When the water is above the highest, or below the lowest, they fail entirely; and when foaming oeeurs no dependence can be placed upon them. In this case the error is most dangerous, as the indieated level of the water may be several inehes above its true level. Notwithstanding the imperfeetion of these instruments, they are still employed to a very eonsiderable extent, and their indications relied upon in determining so vital a question to the safety of all concerned as the height of water in the boiler.

The ordinary safety-valve, and eontrivances whieh employ fusible alloys, are the chief devices embraced in the second class, or those which relieve the boiler from exeess of steam by the foree of pressure alone, or by temperature independent of pressure.

The safety-valve was introduced by Papin in his digester, was applied by Savery to his engine, and has ever since been relied upon as the prineipal means of relieving the boiler from excessive pressure. Its eonstruetion is too well known to need description. The two forms most commonly employed are the eonieal and dise valves; the former, from the faeility with which it ean be tightened to prevent waste of steam, has been more generally employed than the latter. Its greater tendeney, unless the eone be very obtuse, to beeome adherent to its seat has been urged as a foreible objection to its use. The dise-valve is not so liable to this eause of danger, and is preferred by the Franklin Committee. They adopted it in their experiments, and found that when kept in fair working order no adhesion took plaee.

But its liability to corrosion and adhesion are not the chief objections to the safety-valve, when, under the control of reekless men, it may be, and there is abundant proof that it often is, loaded far beyond the highest estimated working pressure of the boiler. A boiler, moreover, may be burst by a force below its ordinary working pressure, when the tenacity of the metal has been diminished by heat ; and in sueh a case, of course, the safety-valve would have no tendency to relieve it. The evolution of steam, too, might be so sudden that the valve eould not give it an exit sufficiently rapid to prevent explosion. The safety-valve, then, though an indispensable appendage to the steam-boiler, is liable to these sources of failure, and therefore cannot be implicitly relied upon as a means of safety. It is laeking in some of the most essential of the qualities which have been pointed out as requisite in an apparatus which should satisfy the demand for perfeet proteetion.

The fusible plates required to be attached to every boiler, by the ordinance of the Freneh Government, are plugs of an alloy so compounded as to melt, and so give vent to the steam, at a temperature corresponding with the greatest pressure under which the boilers are allowed to work. To prevent their giving way as they approach the fusing point, they are covered by wire gratings or perforated metallie discs. The experiments upon these plates made by the Franklin Committee show that when fusible alloys are subjected to heat and pressure at the same time the more fusible portions are melted first, and foreed out by the pressure to which they are subjected. The residuary mass is thus left with a fusing point much above that at whieh the alloy was caleulated to melt. Every repetition of the fusing process under these eircumstances was attended with a rise of the temperature required to produce the result. It is evident that the protection afforded by fusible plates, used in this way, diminishes in proportion as the necessity for it is inereasing by the deterioration of the boiler from age and use. The liability to this action has been considered a suffieient reason for deciding that no effieient practical applieation of these alloys ean be made while they continue to be subject to pressure.*

To obviate this diffieulty, Professor Bache devised the plan of enclosing the fusible metal in a tube inserted into the boiler, thus subjecting it to the aetion of temperature alone. The melting of the alloy in the bottom of this tube sets free a rod connected with an alarm apparatus, and if necessary with the safety-valve. The same idea occurred about the same time to Mr. C. Evans, of Pittsburgh, Pennsylvania, whose safety-guard is identical with the device of Dr. Bache.

The safety-guard of Mr. Evans consists of a tube inserted through the top of the boiler, with its bottom resting on one of the flues. A small quantity of fusible alloy is plaeed in the bottom of the tube, in which a spindle is inserted, so arranged as to be eapable of turning only when the metal is in a state of fusion. On the upper end of this spindle is a small drum, around which a eord is wound. This eord passes over a pulley attaehed to the end of the lever of the safety-valve, and has fastened to it the weight which keeps the valve down. The operation is simple; the alloy being melted, the spindle is, as it were, unsoldered, and allowed to turn; the cord is unwound from its drum ; the weight falls on to a support prepared to receive it, and the safety-valve is entirely relieved. The advantages of this plan are that it not only indicates danger, but relieves it, and that the spindle is self-adjusting. The only operation requiring the attention of the engineer is the rewinding of the cord, an operation which could not be negleeted witheut stopping the engine. The apparatus, however, is as liable to be tampered with as the common safety-valve; it is aeted upon by temperature alone, and would not indieate a defieieney of water unless sueh deficieney were oecasioned or accompanied by a rise of temperature suffieient to melt the alloy. The range of temperature in fusible alloys, between perfect fluidity and perfect hardness, is an important consideration with referenee to the comparative sluggishness of the apparatus in whieh they are employed. The property most desirable in alloys used in the safety apparatus of engines is of course a small range of temperature in changing from the liquid to the solid state, as the promptness of the apparatus depends upon this quality. The Franklin Committee found that, with reference to this range, those alloys should be preferred which contain the smallest quantities of lead; and, for the same reason, those containing the smallest proportions of bismuth.

The comparative sluggishness depends so much upon the particular composition of each alloy, that no satisfactory general conclusion can perhaps be drawn from an average result. Alloys compounded to melt at high temperatures (where, of eourse, the necessity for promptness is greatest) have fortunately a less extensive range between fluidity and hardness than those intended to give way at low temperatures. The average result obtained by Professor Johnson from experiments on 140 specimens makes this range 31.1° Fahr.,† so that, when a mass of sueh alloy has beeome perfectly fluid, it requires that number of degrees of heat to be ab-

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* " Frank Jour.," vol. xvii., p. 9.

† The employment of these gauges was enforeed by ordinanee of the French Government in 1830.

‡ Sen. Doc. 405, 28th Cong., 1st session, pp. 13, 43.

§ Ibid, p. 44.

‖ Ibid, p. 16.

* General Report, p. 11.

† Senate Document, 405, 28th Congress, 1st session.

stracted before it becomes again perfectly hard. This whole difference, however, is not operative in practice in the case of Evans's apparatus; for it was found, by the commission of 1843-44, that the average difference of temperature between fusing and setting is only about 7 or 8°, showing that the action of the weight upon the spindle causes it to turn before the alloy has become perfectly fluid, and that the alloy is sufficiently set to support the weight before it has become perfectly hard. Still a range of 7° or 8° in a boiler under a pressure of five or six atmospheres would require the pressure to be diminished from two to two and a half atmospheres, after the action of the apparatus, before it would be again ready to act. This diminution would be attended with a loss of both water and heat. The range of temperature between the opening and closing of a common safety-valve in ordinary working order was found in the same research to be about 5°, showing a difference in favour of the valve of about 3°. The comparison, however, is not intended to be carried further than this single point. The fusing point of the alloy does not change materially by the repetition of the melting process. On the whole, Mr. Evans's apparatus, when the alloy is properly prepared, the apparatus fairly used and not tampered with, is one upon which considerable reliance may be placed for the purpose which it professes to accomplish—the indication and relief of a dangerous elevation of temperature in the metal of the boiler.

The expansion-guard of Mr. Wright makes use of the different expansibility of metals as an indication of the temperature of the boiler, and a means of relieving the safety-valve, where the elevation of temperature is such as to indicate a dangerous increase of pressure. A brass tube, closed at its inner end, is inserted into the boiler head, immediately over one of the flues. In this tube, but lying loosely, and attached only to its inner end, is a rod of iron, projecting on the outside a short distance beyond the head of the boiler. When the brass tube is heated it expands, and of course projects further into the boiler, carrying with it the less expansible iron rod. The outer end of this rod moves an index which shows the temperature of the metals, and is attached to a catch which operates to relieve the safety-valve, as soon as a dangerous pressure on the boiler is indicated by the temperature attained.

With regard to all self-acting apparatus intended to relieve the safety-valve, it ought to be borne in mind that their operation is attended with a consequence which might, under some circumstances, prove a very serious disadvantage. It is, that the boat may be deserted by its power at the moment of greatest need. In going through such a passage as Hell-gate, for instance, such a desertion, even if but momentary, might be attended with fatal results. This view would seem to justify a preference for apparatus intended to give an alarm, over those which operate spontaneously to relieve the safety-valve. Where engineers are careful, there can be little doubt of the propriety of such a preference.

The third class of safety apparatus includes such as act by deficiency of water, combined with the pressure, to relieve from the dangerous tension of steam.

The double-acting safety-valve of Mr. Raub differs from the ordinary safety-valve in having a float and additional lever attached to it, so arranged that the fall of the float below the proper water line opens first a small valve to sound an alarm, and, if the fall continues, raises the main safety-valve. The small valve opens downwards; and it was found that in boilers using high steam the pressure was sufficient to keep it closed, thus reducing the apparatus to the common safety-valve, "to which," in the opinion of the board to whom it was submitted, "it is in no respect superior." *

The hydrostatic safety apparatus of Mr. Duff is a valve with a large hollow head, from which a tube passes down below the ordinary level of the water in the boiler, to the lowest permissible line. So long as the mouth of the tube remains below the water, the valve head is kept full of water, which thus forms the greater part of the load; but when the water in the boiler falls below the mouth of the tube, that in the valve head is, of course, discharged into the boiler, thus relieving the valve of its load. The time taken to discharge the water from the valve head renders the operation of this apparatus sluggish; and, as it is liable to be brought into action by any sudden change of level in the water, though such change may be unattended with danger, it is not considered applicable to the boilers of steam-boats.

The interior safety-valve of Mr. Easton is placed, as its name imports, entirely within the boiler, and is not liable to be tampered with by the engineer while the boat is in motion. The valve opens downwards, and is kept closed by a lever of the first order. There is a float attached, the fall of which raises the long arm of the lever and opens the valve. A rod (called a feeler), passing through the top of the boiler immediately over the valve, enables the engineer to open but not to close it. The valve was found upon experiment to open promptly, the mean difference between the opening and closing pressure being only 5.32 pounds. This apparatus, however, does not indicate whether the escape of steam is due to the fall of the water in the boiler, or to a pressure beyond its load. This may be ascertained, however, by raising another valve, when, if the opening of the interior valve be caused by excessive pressure, it will at once close, but if from deficiency of water it will continue to blow. Mr. Easton's apparatus is favourably spoken of by the board by whom it was examined. It was tried by them, however, under favourable circumstances, and with pure water. Its efficiency on the muddy waters of the west this office has no means of ascertaining.

The several forms of apparatus for supplying water, without indicating either temperature or pressure, constitute the fourth and last class.

The instrument for this purpose, ordinarily employed, is the common force-pump worked by the engine. Its liability to obstruction, and the fact that it operates only while the engine is in motion, constitute the chief objections to it. Many boats employ subsidiary pumping-engines which supply water during the stoppage of the main engine.

The self-acting pumping apparatus of Mr. Barnum is brought into action by a float, the fall of which below the due water line opens a valve which supplies steam to a subsidiary pumping-engine. A deficiency of water sets the pump in action without the agency of the engineer, and a full supply stops it. An ingenious double valve has been applied to it, which prevents the pressure of the steam from counteracting the weight of the float, thus rendering it applicable to high as well as low pressure boilers. The trials made by the board of examiners with this apparatus were, in general, highly satisfactory.

Having thus glanced at a few of the more prominent mechanical devices for the prevention of explosions, some of which claim to be important improvements upon the safety apparatus of the steam-engine, the undersigned does not feel called upon to express any opinion as to their relative merits, still less to point out any particular apparatus as best calculated to meet the wants of the public. Even if any one of these contrivances could be singled out with certainty as the best existing plan for obviating danger of explosion, it is not believed that its employment ought to be recommended as the subject of compulsory legislation by Congress. These plans are all before the public, who have a vital interest in selecting the one best calculated to secure their lives and property. Nothing can add to the force of motives drawn from the love of money and the desire of self-preservation. If the apparatus selected for Government protection were not the best, the law would be evaded, or openly disobeyed; if it were the best, and yet not a perfect safeguard, its protection would operate as a check upon the ingenuity of inventors by taking away its strongest stimulus. The source of danger, in the opinion of the undersigned, is to be looked for elsewhere than in the imperfection of the engine or its appendages, and the legislative remedy ought to be applied in a different quarter.

The legal remedies for explosions, then, are the next subject to be considered. These are either preventive or penal. The preventive measures are such as relate to the qualities of the engine, and the qualifications of those who are to inspect or manage it. The penal provisions are those which provide for actions, civil or criminal, against the parties through whose fault injury has been committed.

Before submitting any suggestions or recommendations, "with reference to further legislation by Congress for the prevention of the explosion of steam-boilers," it is deemed proper to lay before the Senate the objections which are entertained by practical men to the existing laws, together with the modifications of them which they propose.

The laws now in force are those of July 7, 1838, and March 3, 1843. The third section of the law of 1838 gives to the "district judge of the United States within whose district any ports of entry or delivery may be" the appointment of inspectors to make inspection of the hulls, boilers, and machinery of "vessels propelled in whole or in part by steam."

[*To be continued.*]

* Senate document, 405.

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THE CHEMICAL TIMES.

SATURDAY, OCTOBER 13, 1849.

THE METROPOLITAN PURE-WATER QUESTION.

THERE is a most prevalent, and not less prevalent than fatal, opinion afloat that water which is limpid, pellucid, and transparent, must, in virtue of these qualities, be pure. Hence do we find the *ad-captandum* empiricisms of the filter-shops, with their sparkling glass vases and pellucid contents, the same drawing their polluted source from the muddy waters of the nearest sewer, or their aggregate—the Thames. At this epoch, when the fungoid theory of cholera is so justly prevalent—when the Board of Health has vindicated its claim to be something more than an anomaly—when graveyards are being closed, and gullyholes are being trapped—when a popular outcry is being made against intermittent water supplies doled out by mercenary companies, and the popular cry is being raised for an unceasing and unlimited supply of this first necessary of life from some unpolluted source, let us hope that the fatal ignorance of considering clear and transparent water *necessarily* pure be well contemplated by the Legislature before the taking of any step involving the outlay of money or time. Nothing but the mechanical or floating impurities can be separated by filtration—che-

mically-dissolved impurities, the more numerous of the two, are never removed by filtration at all,—indeed, the plans of removing organic matters from water on the large scale are so difficult, if not impossible, that our endeavours should be preventive or anticipatory rather than remedial. We should carefully examine the proposed water sources, and select that which is most proper for the purposes desired.

THE USE AND ABUSE OF FISCAL CHEMISTRY.

A LEADER appeared on the tobacco question in the *Daily News* of the 10th instant, the obvious end of which is to write up Dr. Ure, and to write down Professors Phillips, Graham, Brande, and many other *respectable* members of the chemical profession. Now, we will not commit ourselves to the assertion that this leader *was* written by Dr. Ure himself; but we have not the least hesitation in affirming, from a consideration of various peculiarities in its style, that it *was* written by the only chemist *ever black-balled by the Chemical Society*.

As regards the truth or falsehood of the individual case of presumed adulteration of tobacco by sugar we know nothing, and care as much. As regards the general proposition, however, that Professors Brande, Graham, R. Phillips, *et id genus omne* whom we need not further particularize, as forming a well-known and much-honoured class—as regards the proposition, we say, that these gentlemen are incompetent to discover the presence of sugar in tobacco, whilst that feat is wholly and entirely reserved for Dr. Ure—we feel confident we are capable of offering a pretty safe opinion.

The question at issue, stripped of all its accessories, simply amounts to this, whether, as a test of sugar, the appreciation of the formation of alcohol by the fermentive process, or Trommer's test, viz., the action of sulphate of copper and potash, be the more satisfactory test of the two. The latter, be it observed, only exerts a positive manifestation on glucose or grape-sugar, the former may be said to indicate the presence of either glucose or cane-sugar; but, inasmuch as cane-sugar changes into glucose invariably before the elimination of alcohol, we may assume glucose to be the body always sought for in the cases under consideration. Now, Dr. Ure abjures *in toto* the results deduced from the fermentation test—considers them obscure, veiled, and incorrect—prescribes what he calls a German process of testing—and sets the latter up in proud superiority to the deductions of the gentlemen he so unsparingly depreciates. With Dr. Ure it is the *German test*, *i.e.*, Trommer's test, which is all in all—it is this which is to aid the Customs in future to levy their tobacco imposts. Now, we can only say in this matter, that to our mind no proof of the existence of sugar should be accepted, otherwise than the proof of its actual isolation and production; but, if indirect tests are to be received at all, then unquestionably the development of alcohol is a much better one on which to pin the faith than the most fallacious mode of procedure propounded by Trommer—a procedure which we have convinced ourselves, by numerous experiments, is capable of yielding results indicative of sugar by the agency of numerous organic bodies—bodies as widely different from the constitution of sugar as Dr. Ure is different from those he vilifies.

HEALTH OF LONDON DURING THE WEEK.

[From the Registrar-General's Report.]

The number of deaths from all causes registered in the week ending last Saturday is 1,290, and again exhibits an important decrease on the previous week. Since the first week of September, when the total deaths were 3,183, the mortality has steadily declined, and is now, happily, not much in excess of the rate that usually prevails in the last quarter of the year. Cholera has fallen more rapidly than it increased, for during last week the deaths registered were 288, a number in the fourth week of its decline which differs not much from the number returned about eight weeks before it attained its greatest fatality. Diarrhœa and dysentery also decrease, but more slowly. It will be observed, however, that the deaths from these two forms of disease last week, namely, 146, are hardly less numerous than those of part of the years 1846 and 1847, when the periodical increase was unusually great. In St. Giles only one death from cholera was registered last week; in East London, West London, and City of London, the deaths were 12, those in the previous week from cholera having been 26; in Lambeth the deaths in two weeks have fallen from 50 to 24. It lingers in Fulham, and in some other districts the recent improvement is not remarkable. Other epidemics, with the exception of typhus, are near the average. With reference to smallpox, Mr. Holl states that he has registered only two deaths in the hospital for this disease (in Camden-town sub-district) in three months. Within this period the house has been nearly empty, at one time there was but a single patient, and all the cases were of a mild form. A man of 62 years died in Aldgate of "destitution" (according to the coroner's verdict).

The mean height of the barometer in the week was 29.374; the mean temperature was 51°2′, less than the average of the same week in seven years by about two degrees. The temperature was considerably lower than in previous weeks; and on some days rain fell heavily.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

William Buckwell, of the Artificial Granite-works, Battersea, Surrey, civil engineer, for improvements in compressing or solidifying fuel or other materials. Patent dated March 28th, 1849. Enrolled September 28th, 1849.

This invention consists in solidifying and compressing fuel, by percussion, into blocks suitable for stowage. The fuel (coke for example) when reduced to a granulated state and moistened with water, or by the humidity of the atmosphere, is placed in a stout cast-iron cylinder, faced on the inside with wrought iron or steel, and subjected to the action of a steam-hammer of three tons weight, and making fifty strokes a minute. It is stated that it has been found advisable not to force the block of fuel out of the cylinder immediately after the stroke. And for this purpose a piece of iron is, in the first instance, placed in the cylinder and allowed to rest upon a prop, which works up and down like a piston in a steam cylinder, and is securely supported against the bottom of the iron at the extremity of the up stroke during the moment of percussion. The descent of the steam-hammer drives out the iron block, and forces the powdered fuel, which was placed above, into its place, whereby it will be compressed and solidified. The iron block is then laid aside, and the compressed fuel separated from that in powder, which is above, by the interposition of an iron plate. The blocks of compressed fuel are subsequently dried by exposure to the atmosphere or to heated air. When the granulated fuel is too dry or too moist, which would destroy the effect of impact, it will soon be made manifest by the escape of a quantity of powder or by the exudation of moisture through the side; but the experience of the workman will soon enable him to arrive at a knowledge of the degree of moisture which is requisite to ensure the successful working of the invention.

Claim.—Compressing and solidifying fuel in moulds by percussion.

John Britten, of Birmingham, manufacturer, for certain improvements in the means, apparatus, and appliances for cooking, preserving, preparing, and storing drinks and articles of food, and in preparing materials for constructing the same; also in constructing vertical roasting-jacks and chains for the same, applicable to other chains, parts of which improvements are applicable to other similar purposes. Patent dated March 28th, 1849. Enrolled September 28th, 1849.

Mr. Britten's improvements are as follows:—

1. Constructing an inside mantelpiece in a kitchen range, with doors extending to the hobs, so as to form a kind of bonnet, for the purpose of preventing the chimney from smoking.

2. Heating ovens by combining the bottom draught with the current of heated air.

3. The employment of an additional damper, in order that the top draught may be cut off without closing the bottom one.

4. Heating ovens by causing hot air to pass under the bottoms of, and to circulate through, them, whereby the use of the hollow crown is dispensed with.

5. Heating ovens by air, which is heated by being made to pass through the hollow cheeks of the range which partially project into the oven.

6. Taking the air employed to heat the hot plate from a point nearer to the burning fuel than has hitherto been usual.

7. Fixing a small lever upon the inside end of the handle of pendent oven doors, which takes into a notch in the bolt, so that when the handle is pushed towards the door the bolt is shot and the oven closed, and when it is lifted up the bolt is drawn and the door allowed to fall. The handle may be made to serve as a support to the door.

8. Regulating the supply of water to kitchen, steam, and other boilers, by a ballcock, which is in the form of a hollow semi-hemisphere, and is placed with the mouth downwards, so that when there is no steam given off it falls down, and allows water to flow in; but when steam is generated the water is thereby displaced, whereby it rises to the surface, and shuts off the supply.

9. Burning the fire-clay slabs employed in the construction of stoves and ovens, by the application of hot air, and causing the hot air which escapes from one kiln, when the work is done, to heat the air supplied to feed the combustion of the fuel in the next kiln.

10. Preserving corn or other grain by constructing the apartments in which it is stored with perforated floors, through which air is forced from air-tight vessels, placed underneath, and consequently made to circulate through the grain.

11. Constructing the works of vertical tubular jacks upon the bottom plate, which is dropped into the outer case, and retained in position by means of a set-screw.

12. Manufacturing jack-chains by twisting iron rods or wire round the spit. Each turn of the rod or wire is then divided at the broad part of the spit, and the links formed by means of a die or stamp.

Claims.—1. The employment of an additional damper.

2. The mode of regulating the supply of water to boilers.

3. The burning of fire-clay slabs by the application of hot air, and heating the feed air of one kiln by the exhaust air of the preceding one.

4. The mode of constructing jack-chains, and its application to the manufacture of other chains.

James Lawrence, the elder, of Colnbrook, Middlesex, brewer, for an improvement or improvements in brewing worts for ale, porter, and other liquors, and in storing ale, porter, and other liquors. Patent dated March 28th, 1849. Enrolled September 28th, 1849.

1. The improvements in brewing worts consist in the employment of a vertical or horizontal refrigerator for the purpose of cooling them. The vertical refrigerator is constructed in the form of a cistern, the sides of which are of wood or metal, and which has on each side, but separated from it, a series of small chambers, communicating in pairs, and having each an airhole at the top, which may be plugged up when required. A number of thin horizontal copper tubes, about three quarters of an inch in diameter, are supported in the sides of the cistern, and establish communication between the corresponding chambers on either side of it. Cold water is pumped in through a supply-pipe in the bottom, and allowed to flow out at top. Wort is supplied to the top chamber of one series, whence it flows through the tubes into the top chamber of the other series, and drops into the one beneath. It then returns through the tube to the second chamber of the first series, and so on, flowing backwards and forwards through the tubes, which are cooled by the passage of water amongst them, until it reaches the bottom, where it is received in suitable receptacles. The tubes are made to have a slight fall to facilitate the passage of the wort through them, and doors are constructed in the side of the chambers to allow of their being cleansed when required. The difference between the horizontal refrigerator and that just described is so trifling as not to require description, with the exception, perhaps, of the cistern, which contains a number of partitions attached to either side thereof, alternating, and reaching nearly to the opposite one, so that the spaces will also alternate from side to side, and consequently cause the water to flow along the entire length of the copper tubes. The water flowing in one direction and the wort in another, it follows that as the temperature of the latter decreases it will encounter a colder stream of water than at the beginning. The patentee states that with either of these apparatuses he has been enabled to reduce boiling wort to 52° F. in much less time than it can be reduced to 100° F. by the present system of cooling in open pans.

2. The improvements in storing ale, porter, and other liquors, consist in placing a vessel or bag of indiarubber, or some other impermeable material, filled with water, upon the top of the vat, and immersing the lower part of it in the contents of the vat. If the water is changed once in twenty-four hours, the contents of the vat will keep cool, during the summer months, for a very considerable time.

Claims.—1. The improvement or improvements in brewing worts for ale, porter, and other liquors.

2. The improvement in storing ale, porter, and other liquors.

Henry Howard, of Railway-place, Fenchurch-street, London, for certain improvements in the manufacture of glass, also in the construction of furnaces for melting and fining the same. Patent dated March 28th, 1849. Enrolled September 28th, 1849.

This invention consists in placing the descending flues between or behind the pots, and in contracting the furnace so as to maintain the flame on a level with them, and by these arrangements cause the heat to encircle and impinge against the pots, thereby effecting a uniformity of temperature and facilitating the melting process. The descending flues are represented as being placed in the four corners of the chamber appropriated to the reception of the pots, which are placed between them and the furnace. The patentee shows the application of his invention to a three and five pot furnace; and also a double furnace arrangement, with a number of holes for feeding in the fuel, and "teazer holes" to permit of access to the pots.

2. It is proposed to place a thin sheet of platina above the furnace, supported in a suitable manner, in order to prevent the "droppings" falling from the crown into the refining-pots.

3. The annealing furnace is constructed with the flues in the centre, on a level with the bottom, and with holes in the top, for the purpose of cooling down the metal and admitting light when the contents are to be removed.

Claims.—1. The peculiar contruction of furnace for melting and casting glass, in which the flame is made to encircle and impinge directly against the sides of the pots, effecting thereby uniformity of heat and an improved quality of material.

2. In the portability of the construction of furnaces for melting glass, with one or more working holes.

3. The adaptation of a sheet of platina to the crown of melting and refining furnaces, to prevent the droppings falling into the pots.

4. The peculiar form and construction of an annealing furnace with flues in the centre near the bottom, and holes in the top for allowing the heat to escape and admitting light when emptying it of its contents.

Alfred Vincent Newton, of Chancery-lane, for improvements in separating and assorting solid materials or substances of different specific gravities. Patent dated April 2d, 1849. Enrolled October 2d, 1849.

Claims.—1. Subjecting the ore to the grinding or crushing action of several pairs of rollers, each pair being further asunder, and revolving at a greater velocity than the preceding one.

2. A mode of assorting the lumps of ore according to their sizes, in order that the pieces which do not require to be ground by the first pair of rollers may pass to the second, and so on throughout the series.

3. A certain method of drying the ore preparatory to the grinding process, and between that and the screening process.

4. An arrangement of apparatus for screening the ore, and separating it into parcels of equal or nearly equal sized particles.

5. The subjecting the ore, in masses of equal or nearly equal sized particles, in combination with the grinding, drying, and screening processes, to a current of air when falling by gravity, which separates it into parcels according to the specific gravity and value of the various particles.

6. The use of shoots to conduct the different particles of pulverized and dried ore, assorted according to the sizes of the particles, into chambers, where they are separated according to their specific gravities into different bins.

William M'Bride, jun., of Sligo, Ireland, but now of Havre, France, merchant, for improvements in the apparatus and process of converting salt water into fresh water, and in oxygenating water. Patent dated April 2d, 1849. Enrolled October 2d, 1849.

The patentee, who has disclaimed the words, "and in oxygenating water," states that his invention consists in condensing the steam of salt water by a current of cold air. For this purpose he employs a vessel filled with water of a lower temperature than the surrounding atmosphere, and containing a zigzag tube, which is placed above a reservoir for receiving the condensed steam. The tube is supported in the upper part of the opposite sides of the vessel; one end is connected to an exhausting machine, and the other opens just in front of, and a short distance from, the steam supply-pipe, whence it descends to the bottom, which it passes through, and opens into the reservoir beneath. The vessel is furnished with an air escape-pipe at top, and the reservoir with a cock for drawing off the condensed steam as may be required. The exhausting apparatus is an ordinary blowing-machine, the action of which is reversed in respect to the tube, with an accelerating motion between the axis of the winch-handle and the axis of the fan. The axis of the large driving-pulley is supported in the bottom of a rod, which slides in a slotted piece, and, passing through the upper part of the machine, is screwed at top, and furnished with a nut, whereby the friction of the driving-strap may be regulated as occasion may require. When the machine is put in action by manual labour, and steam made to flow from a boiler through the supply-pipe, the latter will be drawn into the zigzag tube, together with a current of cold air, and condensed.

Claim.—Condensing the steam or vapour of heated sea water, brine, or other salt water, by a current of cold air, which gathers it into a condenser by means of an exhausting or other blowing machine.

William Hartley, of Bury, Lancashire, engineer, for certain improvements in steam-engines. Patent dated March 28th, 1849. Enrolled September 28th, 1849.

Claims.—1. Working the steam-valves of steam-engines, having Cornish equilibrium or ordinary disc valves, by means of oscillating cams working on a compound tappet-shaft, independently of the ordinary tappet-shaft.

2. Working the steam-valves of steam-engines, having Cornish equilibrium or disc valves, by means of levers and a compound tappet on the fly-wheel shaft, or on another but concentric shaft, with a variable internal guide having two lifts for cutting off and supplying the steam.

3. Working the steam-valves of steam-engines, having Cornish equilibrium or disc valves, by means of two distinct sets of levers in combination with the compound tappet.

4. Working the D valves independently of the slide-valves, so that they may move in the same or in opposite directions.

5. Admitting steam to the cylinder above the valves, and exhausting it through valves placed beneath them.

6. Working the D valves by means of a compound tappet on the axle of the fly-wheel shaft, or on an independent but concentric shaft, with three lifts, for admitting, cutting off, and exhausting the steam, with a variable internal guide.

7. Working D valves by two distinct sets of levers, in combination with the compound tappet.

8. A mode of connecting the variable motion with the governor.

James Thomas Wilson, of Glasgow, for improvements in the manufacture of sulphuric acid and alum. Patent dated March 28th, 1849. Enrolled September 28th, 1849.

This invention consists in employing a glass chamber instead of a leaden one in the manufacture of sulphuric acid. The chamber is to be constructed of sheets or panes of glass, of a thickness indicated by one square foot weighing sixteen ounces, and of any convenient length and breadth, which are supported in a suitable framework of yellow pine, free from knots. The bars have rebates cut in them to receive the panes, and are protected from the action of acid and heat by fillets of glass, which are cemented to their inside surface, and secured thereto by glass pegs or screws. The joints between the panes themselves and between them and the fillets are ground so that they may fit closely together, and are, moreover, rendered perfectly air-tight by a luting being brushed over them. The cements and lutings should, of course, be such as would not be affected by the acid or heat.

2. In manufacturing alum according to Mr.

Spence's process, patented 1845, it has been customary to heat the liquors employed to digest the shale by passing steam through them when all placed in the same vessel, but this mode was attended with this inconvenience, that the liquor could never be raised to a temperature sufficiently high to dissolve all the shale. Now the improvements under this head consist in heating the liquors, in a separate vessel, to 150° or 200° Fah., and then running it in upon the shale.

3. It has been usual to dilute the sulphuric acid with the mother liquors repeatedly, whereby a considerable portion of the acid is thrown out and lost, in consequence of its combination with alumina and iron. The patentee, therefore, proposes to mix them with the ammoniacal liquors of gas-works, to form sulphate of ammonia, which is afterwards mixed with the sulphate of alumina, whereby the fresh and previously-formed alum is deposited.

Claims.—1. The use of glass, in pieces, frames, or sheets, to construct the chambers used by sulphuric acid makers (or other vessel for the same purpose), of whatever form or size, so as to present to the interior a glass surface.

2. Heating the liquors employed in digesting shale in a separate vessel.

3. Mixing the mother liquors with ammoniacal liquors, to form sulphate of ammonia.

James Godfrey Wilson, engineer, Chelsea, and William Pidding, Elizabeth-street, Pimlico, for improvements in obtaining perfect combustion, and in apparatus relating thereto, the same being applicable to every description of furnace and fireplace, as also to other purposes where inflammable matter or material is made use of. Patent dated April 3d, 1849. Enrolled October 3d, 1849.

These improvements consist in introducing and distributing jets or streams of atmospheric air among the burning fuel of a furnace or stove, and in mixing them with the flame of a gas-burner, or spirit or oil lamp; also in constructing air passages in the wicks of mould candles.

Claims.—1. The mode or modes of constructing and arranging apparatus applicable to steam-boiler and other furnaces, whereby the combustion is assisted and more perfectly obtained by the admission and distribution of jets or streams of atmospheric air into and amongst the fuel under combustion.

2. Constructing and arranging apparatus applicable to stoves and domestic grates, whereby the combustion is assisted, and more perfectly obtained, by the admission and distribution of atmospheric air in and amongst the fuel under combustion.

3. The adaptation of hollow air passages to gas-burners, or oil or spirit lamps, whereby the combustion is assisted and more perfectly obtained by the introduction and mixing jets or streams of atmospheric air with the flame of the gas or liquid.

4. Constructing hollow air passages in the wicks of mould candles.

Robert Gordon, Heaton Norris, Lancaster, engineer, for certain improvements in the ventilation of mines. Patent dated April 4th, 1849. Enrolled October 4th, 1849.

Mr. Gordon remarks that the present system of furnace ventilation in coal mines is uncertain and dangerous, in consequence of the liability of the attendant to be rendered heavy and sleepy by the inhalation of noxious fumes so as to neglect his duty, and of the temperature of the current of air to become lowered by the water which oozes through the strata, whereby, if the barometer suddenly falls, or an eddy forms in the up-cast shaft, the ventilation will be stopped; and lastly, of the fire being put out by choke-damp. Now, this invention has for its object to prevent accidents to the miners from the occurrence of any one of these circumstances by closing the mouth of the up-cast shaft, and leading the air from it to the ash-pit of the steam-boiler furnace, the door of which is closed, in order that the air necessary for combustion may all be drawn from the mine. Communication is also opened between the mouth of the up-cast shaft and the chimney direct, for the purpose of enabling the attendant, who will be under the observation of the bank inspector, to prevent such quantity of gas as would put out the fire from passing to it, and causing it to flow into the chimney, up which it will be drawn by the draught from the fire, the furnace-door being opened for that purpose. The patentee also proposes to close the shafts when the miners are absent, and to exhaust as much of the contents as possible, so that the deleterious gases which lurk in the crevices of the mine may be drawn out and adulterated by allowing a current of air to rush in suddenly and mix with them.

Claim.—The construction and arrangement of a chimney with furnace or furnaces in connection with the up-cast shaft of a mine, to obtain more perfect ventilation than at present, including the closing of the down-cast shaft, as occasion may require.

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING OCTOBER 4, 1849.

James Higgins, of Salford, in the county of Lancaster, machine-maker, and Thomas Schofield Whitworth, of Salford, aforesaid, mechanic, for certain improvements in machinery for preparing, spinning, and doubling cotton, wool, flax, silk, and similar fibrous materials. Patent dated September 24th, 1849; six months.

N.B. This patent, being opposed by caveat at the Great Seal, was not sealed till the 2d of October, but bears date the 24th of September, the day it would have been sealed if not opposed.

William Jamieson, of Ashton-under-Lyne, in the county of Lancaster, machine-maker, for certain improvements in looms for weaving. Patent dated October 4th, 1849; six months.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF SCOTLAND, FROM THE 22D DAY OF AUGUST, TO THE 22D DAY OF SEPTEMBER, 1849, INCLUSIVE.

Robert Plummer, of the town and county of Newcastle-on-Tyne, manufacturer, for certain improvements in machinery, instruments, and processes employed in the preparation and manufacture of flax and other fibrous materials. Sealed September 12th, 1849; six months.

William Boggett, of St. Martin's-lane, in the county of Middlesex, gentleman, for improvements in heating and evaporating fluids, and in obtaining and applying motive power. Sealed September 14th, 1849; six months.

William Edward Newton, of Chancery-lane, in the county of Middlesex, civil engineer, for improvements in steam-boilers. Sealed September 17th, 1849; six months.—(Communication.)

John Goodier, of Mode Wheel, Manchester, in the county of Lancaster, for certain improvements in mills for grinding wheat and other grain. Sealed September 17th, 1849; six months.

Alexander Haig, of Smith-street, Stepney, in the county of Middlesex, engineer, for improved apparatus for exhausting and driving atmospheric air and other gases, and for giving motion to other machinery. Sealed September 18th, 1849; six months.

William Henry Phillips, of York-terrace, Camberwell, in the county of Surrey, engineer, for improvements in extinguishing fire, in the preparation of materials to be used for that purpose, and improvements to assist in saving life and property. Sealed September 19th, 1849; six months.

Sir John MacNeill, knight, of Dublin, and Thomas Barry, of Lyons, near Dublin, mechanic, for improvements in locomotive engines, and in the construction of railways. Sealed September 19th, 1849; four months.

PATENTS RECENTLY EXPIRED.

W. S. Henson, Chard, machinist, for certain improvements in certain machinery used in making bobbin-net lace; for the purpose, by such improvements, of making certain kinds of ornamented net or lace with such machinery. Patent dated October 1st, 1835. Expired October 1st, 1849.

E. Hoare, Stonehouse, clothier, for a method of preventing the darkness of colour which frequently occurs near the lists, as compared with the colour of the middle of woollen cloths, in the process of heating them in water, or by steam on rollers. Patent dated October 1st, 1835. Expired October 1st, 1849.

J. Bullough, Blackburn, mechanic, for certain improvements in hand-looms and power-looms. Patent dated October 1st, 1835. Expired October 1st, 1849.

TO CORRESPONDENTS.

"Mr. Ed. Meldrum, Derbyshire."—Wait for the new edition of Phillips's Mineralogy, which will be shortly published.

"Mr. Redhair, Bristol."—1. The change of colour noticed by our correspondent is produced by the action of the chlorine upon the tannin. 2. Bicarbonate of soda. 3. The work is out of print.

"Alpha."—To detect alum in bread, treat a portion of the suspected bread with cold distilled water, and filter the liquor. Test the filtrate for sulphuric acid with one of the soluble baryta salts, and for alumina with solution of sal ammoniac and ammonia. If a precipitate be formed, and you find this soluble in liquor potassæ, and find, moreover, that when heated in the oxidizing flame of the blowpipe, in conjunction with a little nitrate of cobalt, it assumes a beautiful blue colour, these are sure signs that the bread contains alum.

"A. Z."—Grove's battery is the one which answers best for the electric light. The plates are made of zinc and platinum, the wires of copper.

"J. P., Newcastle-on-Tyne." — Grind together black lead with four times its weight of lard or tallow. Add camphor to the mass in the proportion of seven pounds to the cwt.

"W. S. R."—1. The patent expired a fortnight ago. 2. No attempt was made by the patentee to obtain a renewal. 3. The royalty *may* have amounted to £3,000 per annum.

"P."—Communication received.

"Mr. R. Lee, Rathbone-place."—We do not know. You had better address the patentee or his agent.

"Mr. Waltham, Liverpool." — Annotto is derived from the pellicles of the seeds of the bixa orellana. It is imported in cakes, but usually made up in England into rolls, and sold under the name of roll annotto. It is from the latter (which should always be chosen of a good flame colour, brighter in the middle than on the outside, soft and smooth to the touch, of good consistence, and exhaling a strong smell) that the purified or, more correctly speaking, concentrated annotto is prepared, by the following process: — Boil the annotto in a solution of pearlash until the liquid is perfectly saturated with it, and refuses to dissolve any more. Add dilute sulphuric acid (one part of acid to twenty parts of water by weight) until the deposition of colouring matter ceases. Wash the precipitate with a little cold water, drain, and dry it. Care should be taken not to add more acid than is required to precipitate the colouring matter; the liquor should not be rendered acid to the taste.

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ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXXVIII.

(LECTURE CXI.)

VEGETO-ALKALIS—(*Continued*).

ANEMONE.

The officinal anemone, or windflower, is the anemone pulsatilla (Ranuneulaeeæ).

All the anemones are highly aerid plants.

Storek used the anemone pratensis, which differs but little from the anemone pulsatilla.

The active principle of the anemones is volatile.

Heyer was the first to discover that the distilled water of the windflower is charged with the acrid prineiple of the plant. Numerous experiments and observations have since been made (more particularly by Orfila), from whieh it results that the active principle of the plant is highly volatile, so much so, indeed, that the mere drying of the plant suffices to expel the whole of it.

The distilled water of the windflower deposits, after a few weeks' standing, a white crystalline matter, which is apparently almost tasteless and inodorous. When fused in the fire this matter acquires a caustic taste, and exhales an excessively acrid vapour. It is very sparingly soluble in cold, more readily so in boiling, water, and more readily still in aleohol. Vauquelin looked upon this substance as a fatty matter. The observations of M. Robert, of Rouen, and Braconnot, led these ehemists to the same eonclusion.

This acrid matter of the windflower has received the name of anemonina.

Sehwartz has deseribed, under the name of anemonie acid, a substanee whieh appears to be a product of the transformation of anemonina.

Anemonina having never been obtained as yet except as a deposit from the distilled water of the windflower, MM. Blanchet and Sell have suggested that this substanee may, perhaps, be simply a product of alteration of the volatile aerid principle of anemone, whieh, according to this assumption, would gradually combine with a part of the water in whieh it is dissolved, forming thus a erystalline hydrate.

Further experiments are required to test the correctness of this view. The windflower contains, perhaps, besides the volatile acrid matter, some fixed principle analogous to aconitina.

The preparations of anemone have been recommended against amaurosis; they have been used also with suecess in certain cutaneous affections, sueh as ringworm, &c.

DISTILLED WATER OF ANEMONE.

Take of Fresh anemone pulsatilla, 1 part.
Water, a sufficiency.
Distil four parts of product.

EXTRACT OF ANEMONE.

Express the juice of the plant; strain through linen, and pour the strained liquid in thin layers on plates, and evaporate in the stove. Part of the acrid principle of the anemone is evidently lost in this operation. The extract will retain the more of it the lower the temperature at which the process is eonducted.

Another extraet of anemone is prepared by treating the plant with eold water; and a third by treating it with alcohol at 56° Cent. These two extraets differ, of eourse, from that prepared with the juiee of the plant, and ought not to be indiseriminately substituted for it.

The extract of anemone speedily suffers alteration. Dr. Rabenhork found that an extract prepared in spring had lost all its properties in the autumn.

SYRUP OF ANEMONE.

Take of The non-depurated juice of anemone, 1 part.
Sugar, 2 parts.

Melt the sugar in the water-bath in a close vessel at a gentle heat; filter. Dilute the filtrate with nine parts of sugar syrup.—(Mouchon.)

Twelve parts of this syrup are equivalent to one part of the juice.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON MYRICINE.

By BENJAMIN COLLINS BRODIE, Esq.

[*Continued from page* 235.]

MELENE.

It is well known that one of the principal products of the dry distillation of wax is a solid hydroearbon. Ettling, who first analyzed this substance,* concluded from its melting-point, analysis, and general appearanee, that it was identical with paraffine, a hydrocarbon then recently diseovered by Reiehenbach in the products of the dry distillation of wood. The wax hydroearbon has therefore borne the name of paraffine.

This substance was supposed, from the analyses of Ettling and J. Gay-Lussac, to be isomeric with olefiant gas.

Recently, however, this has been contested by Lewy, who analyzed paraffine from various sources, and showed it, as he conceived, to contain a larger amount of hydrogen than had been previously supposed. In truth, the average of his analyses gave:—

Carbon	85.03
Hydrogen	14.87
	99.90

numbers inconsistent with the old idea. The question, however, is. whether M. Lewy experimented with a pure chemical substance, for whieh there is no guarantee.

My own experiments confirm the analyses of Ettling, and the constitution originally assigned to the substance, to whieh theoretieal eonsiderations also lead. But I eannot see any reason to believe the wax hydroearbon to be identieal with the paraffine of Riechenbach. This name of paraffine has been applied indiseriminately to the whole elass of solid hydrocarbons, whieh have, or have nearly, the formula $C_m H_m$, the identity of whieh has been taken for granted, in the absence of any true knowledge as to the chemical nature of the substances from the decomposition of which by heat they are produced. The different melting-points, however, of these substances point out to us at once a distinetion between them. The paraffine of M. Lewy melted at 46°.8. A speeimen of the paraffine of wood given to me by Professor Liebig, and whieh that gentleman received from Reichenbach, its discoverer, melted at 43°.5 C.; Ettling's paraffine at 57° to 58° C. I confess it is diffieult for me to conceive what substance in a state approaehing to purity Lewy analyzed from the wax having the melting-point he has given, sinee nothing is easier than to raise the melting-point of the paraffine from the wax to 56° C., although beyond this any change is effected with diffieulty.

Cerine alone gives on distillation hardly a trace of this hydrocarbon, while it forms a principal product of the distillation of myricine. The palmitic acid is separated by saponifieation, and the general preparation of the substanee is the same as in the similar case of the cerotene from Chinese wax, to which substanee it is closely analogous. If the hydrocarbon from the distillation of the pure myrieine, the aeids having been boiled out with potash, be pressed out in a press between blotting-paper, it will have a melting-point of about 56° C. This can be raised by further crystallization out of ether to 60° C. The analysis of the substanee in this eondition shows the presence of some body eontaining oxygen, in addition to the hydrocarbon:—

	CO_2.	HO.
0.2606 grm. of this substance gave	0.8094	0.3402

giving in 100 parts:—

Carbon	84.74
Hydrogen	14.51
Oxygen	0.75
	100.00

Another analysis gave similar results. This led me to prepare the substance in rather a different manner. The paraffine, having been carefully pressed out in the manner described, was rectified over potassium, which destroys the oxygen eompound. The distillate is perfeetly white: it contains a little oil, whieh may again be pressed out. By crystallization out of pure ether, the melting-point may now be raised to 62° C. This substance was analyzed:—

	CO_2.	HO.
0.261 grm. gave	0.8165	0.3393

giving in 100 parts:—

Carbon	85.31
Hydrogen	14.44
	99.75

The formula $C_m H_m$ demands:—

C_m	85.71
H_m	14.28
	99.99

The difference between the hydrogen caleulated and found is only 0.16 per eent., which is as near to theory as such analyses ean be expected to come. Cerotine melts at 81° C. The hydrocarbon I have called eerotene melts at 57° to 58°. Melissine melts at 85°. The wax hydrocarbon at 62° C., showing a preeisely analogous difference in their melting-points. Owing to the numerous operations which are neeessary before this hydrocarbon ean be proeured in a pure state, I have been unable to make further experiments with the pure substanee. The analyses, however, the analogy of this other substanee, and the mode of its formation, ean leave no doubt but that it is the hydroearbon of the wax alcohol $C_{60} H_{60}$, to which may be given the name of melene.

THE NATURE OF MYRICINE.

The analogy of the products of the decomposition of myrieine, by alkalis and by heat, to those of the Chinese wax and of spermaeeti under similar cireumstances, would lead us to suspect that a similar relation exists between the substanees to which these produets are due. If, however, we take the numbers which have been obtained by analysis for this body, those, for example, of Ettling,* or those of Lewy†, and attempt from these to reckon out a formula whieh shall give a rational aeeount of these decompositions, we find a eonsiderable deficiency of earbon. I give one of Lewy's analyses, with which other analyses of himself and other chemists are sufficiently aceordant‡:—

Carbon	80.28
Hydrogen	13.34
Oxygen	6.38
	100.00

The formula $C_{92} H_{92} O_4$, whieh would account in a simple manner for the deeompositions:—

$C_{32} H_{31} O_3$	$C_{32} H_{32} O_4$
$C_{60} H_{61} O$	$C_{60} H_{60}$
$C_{92} H_{92} O_4$	$C_{92} H_{92} O_4$

requires:—

		Atomic weight.
C_{92}	81.65	552
H_{92}	13.60	92
O_4	14.75	32
	100.00	676

* "Liebig's Annalen," vol. ii., p. 259.

* "Liebig's Annalen," vol. ii., p. 267.

† "Annales de Chimie," vol. xiii., p. 443.

‡ Ibid.

leaving a difference of one and a half per cent. of carbon, a difference too great to be attributed to any accidental error.

I have stated that the decompositions of the myricine are far from being so simple as those of the Chinese wax, and that, in order to obtain either acid or the wax alcohol, long and repeated crystallizations are necessary. This at once led me to the suspicion that the so-called myricine was no pure chemical substance, but a mixture of two or more bodies. Subsequent experiment confirmed this view.

The residue of the wax, after the cerotic acid has been boiled out by alcohol, melts at 64° C. It is but very slightly soluble in alcohol. Pure ether, however, will dissolve it without much difficulty. It crystallizes out of this reagent in light feathery crystals. The precipitate and the residue from the solution, evaporated to dryness, have different melting-points. I succeeded in this manner in raising the melting-point of the precipitate to 71°5.

The following analyses were made of a substance of 72°, which after repeated crystallizations was precipitated on the filter out of the hot solution, the filter being kept hot by means of a hot-water apparatus. I have not succeeded in raising the melting-point beyond 72°. The substance is now highly crystalline in appearance, which the impure myricine is not, and of about the consistency of wax. I regard it in this state as pure :—

	CO_2.	HO.
I.* 0.2592 grm. of substance gave	0.7735	0.3135
II. 0.2243 grm. of substance gave	0.672	0.269

which give in 100 parts :—

	I.	II.
Carbon	81.38	81.70
Hydrogen	13.44	13.33
Oxygen	5.18	4.97
	100.00	100.00

These numbers are very different from any which have been before obtained for any substance from the myricine, and different from those which I myself have obtained for substances of a lower melting-point. The crystalline appearance marks the purity of the substance, and, notwithstanding the slight difference in the hydrogen, I cannot but regard it as the body $C_{92}H_{92}O_4$, with the calculated formula of which, as given above, it sufficiently agrees. I must add that the substance is separable with extreme difficulty. The next precipitate from the solution from which the above substance had been separated had a melting-point half a degree lower, and gave to analysis rather less carbon, namely, C. 81°0 per cent.

The greater part of the difficultly saponifiable portion of the wax appears to consist of the substance the analysis of which I have just given, and to which we may confine the name myricine. We have, however, clearly some other body present accompanying it, the products of the decomposition of which by potash are to be found with both the acid and the wax-alcohol procured by saponification of the impure substance, which, as I have said, render extremely difficult the preparation of these bodies in a pure state. I shall proceed to give some experiments which throw some true light upon the nature of this substance, although I cannot say that its history is satisfactorily made out. The solution of ether or naphtha from which the melissine of 85° has been separated still contains a large quantity of substance of a similar appearance, but of a melting-point much lower than that of the melissine itself. Notwithstanding, however, the differences in the melting-point, analysis shows us but little or rather no difference in the constitution of the different portions of this substance. In the case, for example, of a substance melting at 78°5 C. :—

	CO_2.	HO.
0.2522 grm. gave	0.764	0.324

which gives in 100 parts :—

Carbon	82.59
Hydrogen	14.27
Oxygen	3.14
	100.00

In the case again of a substance melting at 72° :—

	CO_2.	HO.
0.249 grm. gave	0.75075	0.317

which gives in 100 parts:—

Carbon	82.22
Hydrogen	14.14
Oxygen	3.64
	100.00

Other analyses gave similar results.

These analyses do not differ seriously from one another, and give precisely the numbers of the melissine itself. The numbers, however, are consistent with various formulæ besides that of the melissine. At 72° the melting-point is extremely constant. A portion of substance was obtained at this melting-point by repeatedly filtering the ethereal solution from the melissine which first crystallized out of the hot liquid. A time arrived when there was no difference between the melting-point of the portion which first crystallized out of the hot solution and which was on the filter, and that which afterwards crystallized out of the fluid which had passed through. The melting-point in both cases was 72°. By heating with lime and potash, as in the case of melissine, this substance of 72° also affords an acid, which, after the usual preparation, gives very different numbers to those of the melissic acid. This acid melts at 77°5 :—

	CO_2.	HO.
I. 0.256 grm. gave	0.735	0.3015
II. 0.267 grm. gave	0.765	0.311
III. 0.2551 grm. gave	0.730	0.2995

giving in 100 parts :—

	I.	II.	III.
Carbon	78.28	78.14	78.05
Hydrogen	13.09	12.94	13.05
Oxygen	8.63	8.92	8.90
	100.00	100.00	100.00

Between the second and third analyses the substance was twice crystallized out of ether. The substance dissolved by the ether had the same melting-point of 78° as the substance on the filter.

The silver salt of this acid gave the following numbers :—

	CO_2.	HO.
I. 0.5054 grm. of substance gave	1.127	0.4572
II. 0.5182 grm. of substance gave	1.1505	0.467

giving in 100 parts :—

	I.	II.
Carbon	60.80	60.56
Hydrogen	10.05	10.01
Oxygen and silver	29.15	29.43
	100.00	100.00

I. 0.617 grm. gave on ignition 0.1375 silver.
II. 0.7315 grm. gave on ignition 0.1625 silver.

giving per cent :—

	I.	II.
Silver	22.28	22.21

These analyses perfectly agree with the formulæ for the acid, $C_{49}H_{49}O_4$:—

	Calculated.
C_{49}	78.4
H_{49}	13.0
O_4	8.6
	100.0

	Calculated.
C_{49}	60.9
H_{48}	9.9
O_4	6.8
Ag	22.4
	100.0

If we compare the numbers of this acid with those of the substance from the oxidation of which it was derived, we shall see that it is impossible to account for the changes in the same simple manner as in other cases of such transformation. It would not be difficult to reckon out a formula that without great violence should account for it, but it is hardly worth while to do so, since, notwithstanding the perfect agreement of the calculated and theoretical numbers, it is impossible to assert with certainty that either it or the body from which it is derived are pure chemical substances. There is too great a difficulty in the perfect separation of the melissine to lead us to hope that it can absolutely be removed by the method I have given. I failed in attempting to procure in larger quantities this substance of 72°. The melting-point was very constant at 75°, but, on oxidizing a considerable quantity of this substance with lime and potash, acids were procured, which by crystallization were separable in the same manner as the substance from which they were derived, and the purification and perfect separation of which presented the same difficulties. I obtained in this way an acid having nearly the melting-point of 85°, the melting-point of melissic acid, and also an acid with a lower melting-point than 77°, but of which the melting-point was not so absolutely constant as to induce me to investigate it further. I give, however, these analyses, since they unquestionably prove the existence of some other body in addition to the melissine in the products of the saponification of wax, which by oxidation is capable of passing into an acid belonging to the series $C_mH_mO_4$. Since it is only a pure body or a mixture of acids of this series which could give rise to the results I have given, and from the great difficulty of separation, the acid in all probability contains a very large number of equivalents of carbon, whether it have precisely the formula I have above given or not.

Mixed with the palmitic acid of 62° is found another acid of a much lower melting-point, and which presents similar difficulties of separation from the palmitic acid to those of the substance mixed with the melissine from the melissine itself. This acid is very soluble in alcohol, unctuous to the touch, and of a very low melting-point. I do not, however, mean to assert that the other wax-alcohol exists in the wax in combination with this unctuous acid, the presence of which is very probably due to another source.

This alcohol may possibly, as well as the melissine, be combined with palmitic acid, or it may be in some altogether different form in the wax. Even after long boiling with alcohol, the myricine has a slight wax smell, and it is possible that this unctuous acid is the product of the action of potash upon the oil which is one of the constituents of the wax, and from which I have, in fact, procured an acid of this nature. This oil, or rather grease, which was analyzed by Lewy, is a very curious substance. The other constituents of the wax are, in a pure state, inodorous and crystalline, and to it the wax owes its tenacity and peculiar smell. I have made some experiments as to its hature, and procured from it also an acid and an unsaponifiable substance ; I will not, however, here enter upon the matter, hoping at some future time to resume its investigation.

I must not omit to mention, with reference to the beeswax from Ceylon, of which I spoke in a former paper, and which contained no cerotic acid, that it possesses all the general characters of the other portion of the wax. Like the impure myricine, it contains more than one substance. The wax itself has a melting-point of 65°5. When digested with ether in the cold, a portion is taken up by the ether, and a residue left of the melting-point of 67° ; and, when dis-

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* The thorough combustion of these waxes is difficult, and I have made many experiments to ascertain the best method of analysis. Bichromate of lead was the material generally employed. But when the combustion is made very slowly I believe it to be complete even with oxide of copper alone. The greater number of such analyses in this investigation were made by my chemical assistant, Mr. L. Hoffmann, to whose care and skill I am much indebted.

solved in ether, if the ethereal solution be filtered while warm from the first portions of the precipitate which crystallizes out, a substance may be obtained, of the melting-point of 72°, crystalline in appearance, hardly at all acted on by a solution of potash, but readily saponified by melted potash ; resembling, in short, in all its properties the pure myricine. The products of the saponification of the wax itself closely resemble those of the impure myricine, and present similar difficulties of separation.

An acid may be obtained from it having the character of palmitic acid, and I have also procured from this wax the substance melissine, having a melting-point of 84°.

I will sum up the results of this investigation by giving a list of the principal substances of which an account has been given in this and the preceding papers. This table will exhibit, at one view, their relations to one another, and to the natural substances from the decomposition of which they are derived :—

Cerotic acid, cerine $= C_{54}H_{54}O_4$

Chlor-cerotic acid $= C_{54}\left\{\begin{matrix}H_{42}\\Cl_{12}\end{matrix}\right.O_4$

Cerotic ether . . . . $= C_{58}H_{58}O_4 = \left\{\begin{matrix}C_{54}H_{53}O_3\\C_4H_5O\end{matrix}\right.$

Chlor-cerotic ether $= C_{58}\left\{\begin{matrix}H_{46}\\Cl_{12}\end{matrix}\right.O_4 = \left\{\begin{matrix}C_{54}\left\{\begin{matrix}H_{41}\\Cl_{12}\end{matrix}\right.O_3\\C_4H_5O\end{matrix}\right.$

Cerotine . . . . . $= C_{54}H_{56}O_2$

Sulphate of oxide of cerotyle $= SO_3, C_{54}H_{55}O + HO$

Chlor-cerotal . . . . $= C_{54}\left\{\begin{matrix}H_{41}\\Cl_{13}\end{matrix}\right.O_2$

Cerotene, paraffine $= C_{54}H_{54}$

Chlor-cerotene . . $= \left\{\begin{matrix}C_{54}\left\{\begin{matrix}H_{35}\\Cl_{19}\end{matrix}\right.\\C_{54}\left\{\begin{matrix}H_{33}\\Cl_{21}\end{matrix}\right.\\C_{54}\left\{\begin{matrix}H_{32}\\Cl_{22}\end{matrix}\right.\end{matrix}\right.$

Chinese wax . . . . . $= C_{108}H_{108}O_4 = \left\{\begin{matrix}C_{54}H_{53}O_3\\C_{54}H_{55}O\end{matrix}\right.$

Melissine . . . . . $= C_{60}H_{62}O_2$

Chlor-melal . . . . . $= C_{60}\left\{\begin{matrix}H_{45\cdot5}\\Cl_{14\cdot5}\end{matrix}\right.O_2$

Melissic acid . . . . $= C_{60}H_{60}O_4$

Melene, paraffine. $= C_{60}H_{60}$

Palmitic acid . . . . $= C_{32}H_{32}O_4$

Myricine (pure) $= C_{92}H_{92}O_4\left\{\begin{matrix}C_{32}H_{31}O_3\\C_{60}H_{61}O\end{matrix}\right.$

I might add to this list the acid $C_{49}H_{49}O_4$, the constitution of which, however, for the reasons I have given, I cannot consider to be made out with sufficient certainty.

We should naturally suspect some intimate chemical relation between wax and fat from their similar appearance and properties. This suspicion gave rise to the idea that wax was convertible into fat, and to the hypothesis that wax was to be regarded as the aldehyde of stearic acid, and was capable of passing into that substance by a simple process of oxidation, a view of its chemical nature entirely without foundation. From the preceding inquiry we arrive, however, at the knowledge of a no less remarkable relation between these substances.

Margaric acid was recently the last of that singular series of acids of the type $C_mH_mO_4$, which, commencing with formic acid, comprehended acetic acid, the volatile acids of butter, and the acid of spermaceti ; and ethal was the last of the corresponding alcohols. In the wax acids and alcohols, of which an account has been given in this and the preceding papers, we have bodies at the other extremity of the series standing in a similar relation to margaric acid and to ethal, as that in which acetic and butyric acid, and alcohol and potato oil, stand to them at the commencement. An intervening acid of the series, the acid $C_{44}H_{44}O_4$, has lately been discovered by Völcker* in the oil of the Guilandina moringa, and the investigation of the numerous class of vegetable oils and waxes will doubtless afford other bodies of the group.

Notwithstanding the many different properties of these substances, we find their chemical analogies constant, and the mutual relation of the acid, the alcohol, and the hydrocarbon is the same between bodies containing sixty as between those containing only four equivalents of carbon. Through at least half the series, from thirty to sixty equivalents, the same physical type of fat prevails. As a fat is doubtless but a soft kind of wax, so may not alcohol be but a very fluid form of fat ? Alcohol has not yet been solidified, but one cannot help suspecting that when solidified it will appear as a wax or fat.

Direct experiment has shown us that in the body of the bee sugar is converted into wax. A simple analysis of the two substances showed that the carbon and hydrogen were in the same ratio in both, and that the change could be effected by a simple deoxidation of the sugar. Of the way in which this change is effected we are ignorant. The true formula of these wax substances, however, shows that they belong to the very type of bodies which are the ordinary products of fermentation, and are connected with them by the strongest chemical analogies. A new mode of fermentation produced butyric acid out of sugar ; might not another kind of fermentation produce wax ?

Until we know the nature of the whole of the ingredients of the wax, it is useless to speculate on the law of such a change. Although the wax itself is no pure chemical substance, but a mixture of substances differing nearly three per cent. from one another in their amount of carbon, yet the analysis of the whole beeswax gives results showing in different specimens which I have examined no difference of constitution which analysis can reach. This renders it probable that the action is definite, and that the sugar in all cases loses the same amount of oxygen, although the remaining elements may in different cases be differently grouped.

* "Liebig's Annalen," vol. lxiv., p. 342.

ON THE PRODUCTS OF DECOMPOSITION OF ALOES BY NITRIC ACID.

By Prof. MULDER.

Since Mulder published his investigations on chrysammic and chrysolepic acids, a continuation of Schunck's researches on some products of decomposition of chrysammic acid has appeared. Mulder observes that not a single result of Schunck's last investigation is confirmed by his experiments, in which he was assisted by Messrs. Vlaanderen and Rost van Tonningen.

The products of decomposition of aloes by nitric acid were prepared and purified, with a few slight modifications, according to Schunck's directions. One part of aloes was heated with eight parts of nitric acid, then removed from the fire until the action ceased, and evaporated until a yellow powder began to separate. After it had cooled, water was added, when a further large quantity of a yellow powder separated, which was washed with water, and then treated with boiling alcohol. The chrysammic acid, which is far less soluble in cold alcohol, is left for the greater part undissolved on cooling. On further evaporating the liquid filtered from it, aloetic acid separates, which still contains some chrysammic acid. On further evaporation pure aloetic acid separates. Schunck's aloe-resinic acid remains in the brown residual liquid.

Aloetic Acid, $C^{14}H^2N^2O^{10} + HO$, Mulder (according to Schunck $C^{16}H^4N^2O^{13}$).—By repeated solution of the crude product obtained as a yellow powder in boiling alcohol and cooling, &c., this acid is obtained free from chrysammic acid, aloe-resinic acid, and all the other substances contained in the aloes insoluble in nitric acid. It then forms a crystalline orange-yellow powder, which is slightly soluble in cold, more soluble in boiling water, and pretty soluble in alcohol. It bears considerable resemblance to chrysammic acid, but is far more soluble in water and alcohol ; never of so pure a yellow or greenish-yellow as that, but more of an orange colour. It forms with potash and soda very soluble salts, by which means it can readily be distinguished and separated from the salts of chrysammic acid. It forms insoluble salts with baryta and oxide of lead. It dissolves readily in solution of ammonia to a beautiful violet liquid. The action of ammoniacal gas upon this acid is highly remarkable, as will be subsequently shown. The amount of water (1 atom) and the composition of the acid are deduced from the following analyses of the acid and its salts, which differ from those of Schunck. It differs from chrysammic acid $= C^{14}HN^2O^{11} + HO$ by $+H-O$. Boiling nitric acid deprives aloetic acid of 1 atom H, and yields to it 1 atom O when chrysammic acid is formed. The acid, dried at 248°, furnished M. Vlaanderen with :—

Carbon . .	41.6	41.5	41.5	14 = 1051.68	41.4
Hydrogen	1.5	1.7	1.4	3 = 37.45	1.5
Nitrogen . .	14.4	14.5	14.5	2 = 350.00	13.8
Oxygen . .	42.5	42.3	42.6	11 = 1100.00	43.3

Aloetate of Baryta, $BaO, C^{14}H^2N^2O^{10}$.—Aloetic acid diffused in water is digested with a dilute, hot, aqueous solution of acetate of baryta in excess. The nearly insoluble baryta salt washed with water and dried at 248° yielded 27.4 and 27.2 per cent. baryta. The quantity required by the above formula is 28.3. The salt was burnt, when it gave for the acid :—

Carbon	42.7	42.5	14 = 1051.68	43.3
Hydrogen.	1.7	1.3	2 = 24.96	1.0
Nitrogen	13.5	13.6	2 = 350.00	14.4
Oxygen	42.1	42.6	10 = 1000.00	41.3

Aloetate of Lead, $2PbO, C^{14}H^2N^2O^{10}$.—The preceding baryta salt precipitated with acetate of lead furnishes a dark red insoluble precipitate very similar to the chrysammate of lead.

Aloetinamide, $C^{14}H^5N^3O^{10}$.—It has already been stated above that aloetic acid is dissolved by ammonia with a violet colour. Treated with pure ammoniacal gas at the ordinary temperature, or even some degrees below freezing point, it explodes, leaving a black mass insoluble in water, ammonia, alcohol, and potash, and in which Vlaanderen found 68.1 carbon and 1.6 per cent. hydrogen. Chrysammic acid does not behave in the same manner. This explosion may be prevented by diluting the ammoniacal gas with a large quantity of atmospheric air ; the substance acquires a dark violet colour, and water is eliminated. The whole of the combined water is not expelled at 212°. It furnished on analysis, after having been dried at this temperature :—

Carbon	39.16	14 = 1051.68	39.8
Hydrogen	2.54	5 = 62.40	2.4
Nitrogen	20.58	3 = 525.00	19.9
Oxygen	37.72	10 = 1000.00	37.9

It differs from chrysamminamide, $C^{14}H^4N^3O^{11}$, by its much greater solubility in water, its darker violet colour, and in composition by $+H-O$. Even when dilute ammonia is mixed with aloetic acid, this amide is formed. Nitric or muriatic acid instantly convert it into aloetic acid and ammonia.

Hydro-aloetic Acid, $C^{14}H^4N^2O^{11}$, or $C^{14}H^2NO^{11}NH^2$ (anhydrous).—This acid is formed whenever aloetic acid or chrysammic acid is brought into contact with water and protochloride of tin ; and the employment of chrysammic acid as a pigment is based on the production of this acid. Exposed to the air, or even in closed vessels, protochloride of tin gradually separates from the above acids an insoluble violet compound, which, therefore, produces this colour when fabrics mordanted with protochloride of tin are dyed with chrysammic acid.

This compound is best prepared by treating chrysammic acid with water and an excess of protochloride of tin. A heavy dark violet powder is formed which is quite insoluble in the liquid ; it was washed and dried at 248°. This salt has the following composition :—

Carbon.	19.3	..	14 = 1051.68	19.5
Hydrogen	1.1	..	4 = 50.00	0.9
Nitrogen	6.4	..	2 = 350.00	6.6
Oxygen	21.2	..	11 = 1100.00	20.6
Oxide of tin . .	52.1	51.9	3 = 2805.90	52.4

The organic substance combined with the oxide of tin, SnO^2, differs by H and HO from the anhydrous aloetic acid; it differs essentially in its properties, and it certainly contains amide. It is formed from chrysammic acid as follows:—

$$C^{14}H^2N^2O^{12} + 3Sn\,Cl + 5HO = C^{14}H^4N^2O^{11} + 3SnO^2 + 3H\,Cl.$$

When moistened with potash this tin salt is coloured violet blue with disengagement of ammonia. From this circumstance, and from aloe-resinic acid having the composition $C^{14}H_3NO^{12}$, it might be suspected to be an amidogen compound of this acid $= C^{14}H^2NO^{11} + NH^2$; but the brown colour of the aloe-resinic acid is not altered by ammonia. This hydro-aloetic acid is consequently perfectly distinct from what Schunck has considered to be hydrochrysammide, $C^{14}H^6N^2O^6$. Nothing can be concluded from the blue colour of the products which are formed from chrysammic acid, as it furnishes a large number of that colour.

When heated with strong nitric acid the tin salt of the hydro-aloetic acid furnishes oxide of tin with disengagement of nitrous vapours and a red colouring of the liquid. This red colouring first makes its appearance owing to the production of the more soluble salt of aloetic acid. On further ebullition chrysammic acid is reproduced simply by the oxidation of H and H^2, as will be evident from the formulæ. We have:—

Anhydrous hydro-aloetic acid.. $C^{14}H^4N^2O^{11}$
Hydrated aloetic acid ..... $C^{14}H^3N^2O^{11}$
Anhydrous chrysammic acid .. $C^{14}H\,N^2O^{11}$

When potash is added after mixing the hydro-aloetate of tin with nitric acid, soluble aloetate of potash is obtained. If it is now again boiled with nitric acid, and more potash added in excess, the sparingly soluble chrysammate is produced.

Chrysammide, $C^{14}H^4N^3O^{11}$ (Mulder).—What Schunck has regarded under the name of chrysamminamide as an amide of chrysammic acid appears, on comparing his analyses with the calculated numbers, to have been a combination of Mulder's chrysammide with ammonia. Mulder had already alluded to a combination of this substance with oxide of lead, and a similar one exists with oxide of ammonium, which is decomposed at 212°, giving off water and ammonia:—

		Calculated.	Schunck.	
Carbon	14	38.6	37.61	37.88
Hydrogen ..	4	1.8	2.35	2.21
Nitrogen ...	3	19.3	19.72	19.87
Oxygen	11	40.3	40.32	40.04

Further, the substance called amidochrysammic acid by Schunck is a mixture of chrysammide and green chrysammic acid. Several definite combinations of these two substances exist; the most simple one is $C^{14}H^4N^3O^{11} + C^{14}H^2N^2O^{12}$. But this compound has nothing in common with Schunck's amidochrysammic acid, nor with its barytic compound. It is doubtful whether in Schunck's baryta salt there was any chrysammide present; for, if chrysammide is dissolved in water and chloride of barium added to it, no precipitate is obtained. On boiling, it is true, a dark red powder falls which is likewise obtained by adding ammonia to the mixture of chrysammide and chloride of barium at the ordinary temperature; but the two red precipitates are not identical. In the first case, when the boiling has been continued sufficiently long, chrysammate of baryta and chloride of ammonium are produced; in the latter case there is formed chrysammide-baryta and chloride of ammonium. The chrysammide resembles very closely the chrysammate of baryta; but it is readily distinguished from it by its more violet than light red colour, and by its disengaging ammonia when treated with potash.

The compounds of chrysammide do not bear a temperature of 212°; those with two equivalents of base lose the whole of the ammonia, as the lead compound, which leaves chrysammate of lead; those with one equivalent base frequently retain some ammonia.

Chrysammate of Baryta and Chrysammide-baryta, $BaO, C^{14}HN^2O^{11} + BaO, C^{14}H^3N^3O^{10}$.—This double salt is formed when chrysammic acid mixed with ammonia is set aside until the whole is converted into chrysammide; chloride of barium is then added, and the precipitated chrysammide-baryta is dried in the air. At 212° it parts with ammonia; at 248° it becomes anhydrous, but with further loss of ammonia. In the air-dried state the precipitate should have the composition $BaO, C^{14}H^4N^3O^{11} + n\,HO$. When perfectly dry it corresponds in composition to the formula above given, as is evident from the following analysis by Vlaanderen:—

Carbon	30.1	..	28	29.9
Hydrogen	1.5	..	4	0.7
Nitrogen	12.4	12.1	5	12.4
Oxygen	27.6	..	21	39.8
Baryta	28.4	..	2	27.2

The name amido-chrysammic acid, applied to it by Schunck, is consequently no longer suited. Chrysammide is converted by heat and muriatic acid into more or less green chrysammic acid. From his description of it as being dark olive-green, it would appear that his product was nearly pure chrysammic acid with very little chrysammide. His analysis of the amido-chrysammate of baryta likewise agrees pretty accurately with the composition of chrysammate of baryta with two equivalents of water, as follows:—

	Schunck.		
Carbon	29.93	14	28.5
Hydrogen	1.77	3	1.0
Nitrogen	..	2	9.5
Oxygen	..	13	35.1
Baryta	25.11	1	25.9

Aloe-resinic Acid (Mulder), $C^{14}H^3NO^{12} + HO$. Mulder has applied this name to the acid contained in the brown liquid which remains after the treatment of aloes with nitric acid, and separating the two acids previously described. Schunck, in his first memoir, has assigned to it the name aloe-resinic acid, but a different composition; and in his last paper has considered as identical with it a product of decomposition of chrysammic acid, which, however, is distinct.

The brown liquid resulting from the action of the nitric acid upon aloes contains, moreover, the whole excess of nitric acid and oxalic acid. It is saturated with chalk, and the filtered neutral solution precipitated with acetate of lead. The precipitate does not exhibit a constant amount of oxide of lead; but the organic substance combined with it has always the same composition provided the directions given for the preparation of the aloetic acid are accurately followed. The lead salt, suspended in water and decomposed with sulphuretted hydrogen, furnishes on evaporation a brown amorphous mass. Vlaanderen found the following results in the analyses of the lead salts, dried at 266°, for the organic substance contained in them:—

	I.		II.		
Carbon ..	42.7	42.8	42.3	14=1051.68	42.7
Hydrogen	2.2	1.9	2.4	3= 37.44	1.5
Nitrogen .	7.4	7.4	7.4	1= 175.00	7.1
Oxygen ..	47.7	47.9	47.9	12=1200.00	48.7

In I. the salt contained 61.8, in II. 58.4, per cent. oxide of lead. The first quantity corresponds to the formula $C^{14}H^3NO^{12} + 3PbO$, and requires 63.0 per cent.; the second quantity corresponds to the formula $2(C^{14}H^3NO^{12}) + 5PbO$, which requires 58.6 per cent. This last salt can be separated, by treatment with hot water, into the first of the preceding salts, and into a second soluble salt, which is obtained on evaporation, of the composition $C^{14}H^3NO^{12} + 2PbO$. According to what has been stated above, the three acids produced by the action of nitric acid upon aloes stand in their free state in the following relation to each other:—

	Hydrated Acid.	Deducting HO.
Chrysammic acid ..	$C^{14}H\,N^2O^{11} + HO$	$C^{14}H\,N^2O^{10} + O$
Aloetic acid ..	$C^{14}H^2N^2O^{10} + HO$	$C^{14}H\,N^2O^{10} + H$
Aloe-resinic acid ..	$C^{14}H^3N\,O^{12} + HO$	$C^{14}H^2N\,O^{10} + O$

whence their behaviour towards oxidizing and reducing agents is evident. Aloe-resinic acid furnishes with lime, soda, potash, and baryta brown uncrystallizable soluble salts; with lead, copper, and silver brown insoluble salts. They yield on boiling with concentrated nitric acid aloetic acid, which is then converted into chrysammic acid. Aloe-resinic acid is consequently the primitive product of the action of nitric acid upon aloes, which by the exchange of H, N, O is converted into the others:—

Aloe-resinic acid $= C^{14}H^3NO^{12}$, aloetic acid $= C^{14}H^2N^2O^{10}$;

and that is the reason why chrysammic acid which has not been treated sufficiently long with nitric acid is contaminated with aloe-resinic acid, which colours it brown, and with aloetic acid, which imparts to it an orange colour. Thus Boutin's polychromatic acid is a chrysammic acid contaminated with aloetic and aloe-resinic acids.

Chrysatric Acid, $C^{24}H^6N^3O^{15}$ (as contained in the lead salt dried at 266°).—This acid is formed from chrysammic or aloetic acids when they are heated with solutions of the fixed alkalis and alkaline earths. It is similar to the preceding ones in several respects, but decidedly distinct. Chrysammic acid is rapidly dissolved by potash into a brown liquid, in which acetic acid produces no precipitate, but disengages carbonic and formic acids. With concentrated solution of potash the carbonic acid is in greatest proportion, while with a weak solution the formic acid preponderates. During the reaction, concentrated solution of potash expels ammonia, and acids then disengage prussic acid from the liquid, which contains nitric acid. A weak solution of potash does not liberate any ammonia.

Chrysatric acid, or rather a constant lead salt of it, is obtained when chrysammic acid is warmed with an excess of moderately concentrated solution of caustic potash, and then heated to boiling. As soon as the whole is dissolved to a homogeneous brown liquid, it is diluted with water, filtered, and heated with an excess of acetic acid; no precipitate is formed; after cooling, it is mixed with acetate of lead. The brown precipitate, washed and dried at 266°, is chrysatrate of lead, in which Rost van Tonningen found 58.64 and 58.78 per cent. oxide of lead, and for the organic acid combined with it:—

Carbon ..	46.22	46.15	24=1802.88	46.2
Hydrogen	1.89	1.89	6= 74.88	1.9
Nitrogen .	13.01	13.69	3= 525.00	13.5
Oxygen ..	38.88	38.27	15=1500.00	38.4

The lead salt of chrysatric acid which served for the preceding analyses must, from the amount of the oxide of lead, have the formula $4PbO + C^{24}H^6N^3O^{15}$. Chrysatric acid may be produced in the following manner from chrysammic acid:—

$$2\,(C^{14}H^2N^2O^{12}) + 3HO = C^{24}H^6N^3O^{15} + C^2HO^3 + C^2O^4 + NO^5.$$

This expression must be altered when strong caustic potash is used, as ammonia and prussic acid then occur among the products. Chrysatric acid dissolves in water and dilute acids; its salts, with the alkalis and alkaline earths, are soluble; its lead and silver salt insoluble. It is sufficiently distinguished from aloetic acid by its not being reconverted into chrysammic acid on treatment with nitric acid.

The composition of this acid throws further light on the constitution of chrysammic acid. On a former occasion Mulder observed that chrysammide behaved like a conjugate oxamide, and that chrysammic acid very probably contained oxalic acid. We have:—

$$\left.\begin{array}{l}\text{Chrysammide .. } C^{14}H^4N^3O^{11} - C^2H^2NO \\ \text{Chrysammic acid } C^{14}H^2N^2O^{12} - C^2O^3\end{array}\right\} = C^{12}H^2N^2O^9.$$

If we subtract from this residue NO^5, there remains $C^{12}H^2NO^4$, *i.e*, the same group which nitro-picric acid leaves after deduction of $NO^5 + NO^4$:—

Picric acid, $C^{12}H^2N^3O^{13} - N^2O^9 = C^{12}H^2NO^4$.

This same group occurs again in chrysatric acid :—

$C^{24} H^6 N^3 O^{15} - NO^5 2HO = 2 (C^{12} H^2 NO^4)$.

The chrysatric acid was formed from chrysammic acid by the separation of $NO^5 HO + 2C^2 O^3$, and by the assimilation of 3HO. It therefore really appears that chrysammic acid consists of $C^{12} H^2 NO^4$ with 1 atom of oxalic acid + 1 atom nitric acid. We have further :—

Indigotic acid .. $C^{14} H^4 N O^9 = C^{12} H^2 NO^4 + C^2 O^3 + 2HO$

Styphnic acid .. $C^{12} H^2 N^3 O^{15} = C^{12} H^2 NO^4 + O + 2NO^5$

Chrysatric acid.. $C^{24} H^6 N^3 O^{15} = 2(C^{12} H^2 NO^4) + NO^5 + 2HO$

Finally, the following simple expression, which was first discussed by Marchand in his paper on nitro-picric acid, and which has since been further confirmed by Hofmann's researches on aniline, may be given to this series. If, for instance, we admit the conjunct $C^{12} H^4$ in aniline, the conjunct in the picric acid series is $C^{12} H$; and the following substances then stand as follows :—

Nitro-picric acid.. = $C^{12} H + 3NO^4$, HO

Styphnic acid .... = $C^{12} H + 2NO^5 + NO^4 + HO$

Anilic acid . . ... = $C^{12} H + NO^3 + C^2 O^3 + 3HO$

Chrysammic acid = $C^{12} H + 2NO^4 + C^2 O^3$

Aloetic acid..... = $C^{12} H + 2NO^3 + C^2O^3 + HO$

Aloe-resinic acid.. = $C^{12} H + NO^5 + C^2 O^3 + 2HO + O^2$

Chrysatric acid ...= $2C^{12} H + 2NO^3 + NO^5 + 4HO$

Chryiodine, $C^{56} H^8 N^3 O^{28}$, or more probably a conjugate compound of $C^{28} H^4 NO^{15}$ with $C^{28} H^4 N^2 O^{13}$, is formed from chrysammic acid by the action of the hydrate of sulphuric acid at a boiling temperature, with violent disengagement of hyponitric acid (nitric oxide gas). However, when the operation is conducted in a retort, sulphurous acid, carbonic acid, and carbonic oxide can be detected among the products, while a portion of the acid is entirely destroyed. The chrysammic acid is converted into a violet substance, insoluble in water, which becomes gelatinous after washing and of a dark violet colour. Chryiodine of two different preparations gave :—

Carbon	55.9	55.1	56 = 4206.72	55.1
Hydrogen..	1.9	1.9	8 = 99.84	1.3
Nitrogen ..	6.5	6.2	3 = 525.00	6.9
Oxygen ..	35.7	36.8	28 = 2800.00	36.7

The formation of this substance from chrysammic acid results probably as follows :—

$C^{56} H^8 N^8 O^{48} = C^{56} H^8 N^3 O^{28} + N^5 + O^{20}$.

Chryiodine is converted by ammonia into two indigo-blue substances, one of which is a soluble amide, the other an insoluble ammonia compound.

On being heated with strong nitric acid, chryiodine disengages red vapours, and forms a red liquid, from which, on saturation with potash, no chrysammate of potash was obtained. In dilute potash it dissolves with difficulty, forming a violet liquid. Muriatic acid precipitates it from this solution as a violet gelatine.

Chryiodamide, $C^{28} H^8 N^3 O^{13}$, is the precipitate which falls, as above mentioned, when chryiodine is mixed with ammonia. It forms, after washing, an indigo-coloured substance, the composition of which, after drying at 248°, is, according to Van Tonningen :—

Carbon	52.45	28 = 2103.36	52.4
Hydrogen...	2.81	8 = 99.84	2.5
Nitrogen ...	14.03	3 = 525.00	13.0
Oxygen	30.72	13 = 1300.00	32.1

This substance is, therefore, an amide of one of the components of chryiodine, $C^{28} H^4 NO^{15}$. When heated with a concentrated solution of potash it does not lose its blue colour, and is not dissolved by it ; but it parts with ammonia. The blue colour is likewise not altered by muriatic acid, in which it is equally insoluble.

Chryiodine with Oxide of Ammonium, $C^{28} H^{10} N^4 O^{13}$, is left in the solution on treating chryiodine with ammonia. On evaporation it leaves a substance soluble in water. Dried at 248° it furnished :—

Carbon.....	50.1	28 = 2103.36		49.8
Hydrogen....	3.2	10 = 124.80		2.9
Nitrogen	16.4	4 = 700.00		16.5
Oxygen	30.3	13 = 1300.00		30.8

This substance is a combination of the second component of the chryiodine, $C^{28} H^4 N^2 O^{13}$, with 2 atoms of ammonia. The oxide of ammonium compound which originates from it is $C^{28} H^2 O^{11} + 2NH^4 O$. It dissolves readily in potash, when ammonia is liberated, and the blue colour is converted into violet. On being heated with muriatic acid, it likewise changes the blue colour for a light violet one. After this loss of ammonia it is nearly insoluble in cold water.

Chrysindine and Oxide of Ammonium, $C^{28} H^8 N^5 O^{13}$.—When chrysammic acid is heated with ammonia, and sulphuretted hydrogen passed through it, the liquid first becomes violet and then blue. A substance of the same colour is left undissolved. It is thrown upon a filter, and the liquid evaporated, when an indigo-blue residue is obtained. It is difficult to obtain the compound free from sulphur in this manner, which, however, is not essential to its constitution. Dried at 266°, analysis gave :—

Carbon	45.4	47.5	28	48.0
Hydrogen	2.4	2.5	8	2.3
Nitrogen.....	19.2	20.1	5	20.0
Oxygen	28.6	29.9	13	29.7
Sulphur.....	4.4			

This substance appears to be produced by the sulphuretted hydrogen first forming aloetic acid, and from this and ammonia aloetinamide. One atom of nitric acid then separates from a double atom of the latter.

A substance, $C^{28} H^5 N^4 O^{13}$, is obtained when a solution of caustic potash is added to the solution of the preceding compound ; it contains NH^3 less, and is insoluble in potash. It is first washed with dilute solution of potash, and then with muriatic acid. This precipitate likewise contains some sulphur. Analysis gave :—

Carbon.....	51.0	28	50.5
Hydrogen.....	2.1	5	1.5
Nitrogen	17.7	4	16.8
Oxygen.....	29.2	13	31.2

Schunck obtained a substance, on treating chrysammic acid with sulphuret of potassium, which he called hydrochrysammide, and the composition of which he calculated from his analyses to be represented by $C^{14} H^6 N^2 O^6$. But in this case the action is likewise more complicated, for the chrysammic acid is first converted by the sulphuret of potassium into aloetic acid, $C^{14} H^2 N^2 O^{10}$; and then this, by the exchange of O^4 for H^4, into $C^{14} H^6 N^2 O^6$. Schunck's name cannot be retained, because it gives a false idea of the nature of the substance. The separation of 4O is caused by the action of 4 atoms of sulphuretted hydrogen, which likewise produces the assimilation of H^4, 2 atoms of hyposulphurous acid being formed. There is, moreover, in this reaction 1 equiv. nitric acid of the chrysammic acid, or, if it be preferred, of the aloetic acid, decomposed.

Chrysindamide, $C^{28} H^9 N^5 O^{18}$.—When chrysammic acid is dissolved in ammonia, sulphuretted hydrogen passed into it, and the whole boiled and filtered, the liquid furnishes on evaporation a blue sediment, which is the first product of the action of sulphuretted hydrogen upon chrysammide. It gives off ammonia when treated with potash. Rost van Tonningen obtained, on the analysis of this substance dried at 248°, and which was also not perfectly free from sulphur :—

Carbon.....	42.83	34.4	28	43.0
Hydrogen	2.63	2.7	9	2.4
Nitrogen	17.30	17.5	5	17 9
Oxygen	35.84	36.4	18	36.8
Sulphur	1.40			

This substance is produced in the following manner :—

$2(C^{14} H^4 N^4 O^{12}) - NO^5 + 2NH^3 - 2HO = C^{28} H^8 N^5 O^{17}$.

When an excess of sulphurous acid is passed through the solution of chrysammic acic in ammonia, a brown liquid is obtained which is not precipitated by muriatic acid. When an excess of sulphurous acid is passed into chrysammic acid slightly heated in water, and ammonia is then added, the same brown colour is immediately produced. If an excess of sulphurous acid be avoided, a beautiful violet colour appears with perfect solution (as at the commencement on the passage of sulphuretted hydrogen). Muriatic acid disengages sulphurous acid from it, and precipitates a brown-violet gelatinous precipitate.—*Scheidk. Onderzoek*, part v., p. 173.

ON THE NITROGENOUS CONSTITUENTS OF VEGETABLES AS THE SOURCES OF ARTIFICIAL ALKALOIDS.

By Dr. J. STENHOUSE.*

There are few branches of organic chemistry which during the last six or seven years have attracted more attention than the artificial preparation of alkaloids. This is not to be wondered at if we bear in mind the interest which this class of bodies presents both with respect to their definite chemical properties as well as to the medicinal virtue some of them possess. All experiments to prepare artificially such alkaloids as quinine, cinchonine, &c., have hitherto proved unsuccessful ; whilst, on the other hand, the chemist has actually succeeded in preparing by various processes a considerable number of true alkaloids perfectly analogous to those which occur in nature. Several of these artificial alkaloids, as quinoline, narcogenine, cotarnine, &c., are obtained from the natural alkaloids by treating them with certain reagents. A second group, to which furfurine, thiosinnaminc, &c., belong, is obtained on bringing together ammonia and some of the essential oils ; for instance, oil of mustard. A third and very numerous group, containing nitraniline, toluidine, cumidine, &c., is produced by the reducing action of sulphuretted hydrogen or sulphuret of ammonium upon nitrogenous compounds, obtained by treating certain hydrocarbons with nitric acid. A fourth and very important group contains aniline, picoline, petinine, &c., which are obtained in the distillation of fossil coal or of animal substances, as in the preparation of bone-oil and animal charcoal. It is especially to this last group that this notice refers.

It is somewhat surprising that, after the discovery of so many other sources for these alkaloids, hitherto, as far as I am aware, no attempt has been made to procure them from the highly nitrogenous principles which occur in all plants, frequently in very considerable quantity, under the name of vegetable albumen, fibrine, caseine, &c. These constituents contain nearly as much nitrogen as the corresponding animal compounds, on on average about fifteen per cent. The neglect of these substances by chemists is the more remarkable, considering that, of the known sources for the artificial alkaloids, fossil coal has proved one of the most productive, and has furnished besides ammonia four other bases, viz., quinoline, aniline, picoline, and pyrrole, whilst it probably contains several others which have hitherto escaped observation. Now, fossil coal is, according to the general opinion, exclusively of vegetable origin, consisting of the remains of various plants, which in the state of putrid fermentation under an exceedingly great pressure have laid buried in the earth since time immemorial. On thinking over the probable sources of the organic bases in coal, it appeared to me evident that they could not owe their origin to the woody fibre and the other non-nitrogenous vegetable principles of which coal is principally constituted, but that they were derived from the above-mentioned nitrogenous principles which were contained in the plants of the coal formation. We have, therefore, every reason to suppose that, by acting on the nitrogenous constituents of recent plants, the same organic bases, or at all events a series of analogous bases, would be obtained in proportionately

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greater quantity. It will be seen from the following that the latter expectation has not been disappointted. It is difficult to obtain pure vegetable albumen, fibrine, or easeine, in any quantity; instead, therefore, of attempting to purify these substances, I contented myself with selecting those parts of the plants, prineipally the seeds, which contained the greatest amount of those prineiples. I made the first experiment with the common bean (Phaseolus communis). They contain 20.8 per cent. of caseine and 1.35 albumen. The beans were submitted to dry distillation in east-iron eylinders of about three feet high and eight inches in diameter. The produets were eondensed by means of a large Liebig's refrigerator. A eonsiderable quantity of a combustible non-condensible gas, of extremely disagreeable odour, was disengaged. The liquid which passed over was strongly alkaline, requiring about a third of ordinary muriatic acid to saturate it. The distillate resembled in every respect the products resulting from the distillation of bones, flesh, and other animal substances, and contained acetone, pyroligneous spirit, acetic acid, empyreumatic oils, tar, a very large amount of ammonia, and several organic bases. The crude product was treated with a considerable excess of muriatic acid, and the clear liquid decanted after the tar had subsided. The tarry residue was several times exhausted with water containing muriatic acid, and the various extracts mixed and boiled for several hours in a copper pan or in an enamelled iron pan. By this means acetone, pyroxylic spirit, and a great portion of the neutral and acid empyreumatic oils are volatilized or separated by resinification. The acid liquid was, after cooling, filtered through pounded wood charcoal, which retained most of the resinous matter, and then supersaturated with lime or soda in a large still, and submitted to distillation. When the liquid began to boil a large amount of ammonia was disengaged; a quantity of oily bases appeared on the surface of the ammoniacal liquid, which increased in the course of the distillation. As the first portion of the liquid which passed over was richest, it was collected separately; what followed consisted principally of an aqueous solution of the bases, and contained but little separated oil. The distillation was continued as long as the product had an alkaline reaction. The oily mixture which had collected on the surface of the first portion was removed with a pipette and dissolved in muriatic acid, when the neutral oil it contained was left undissolved, and could be separated by filtration through a moistened filter. The solution was supersaturated with carbonate of soda, and rectified in a large glass retort. It was found advantageous to employ a great excess of alkali, as these bases are far more soluble in water than in alkaline liquids; and, therefore, distil over more readily when separated by the alkali. The basic oils collected in the receiver were separated as above with a pipette from the ammoniacal liquid, and preserved in suitable bottles. The slightly alkaline liquids of the preceding distillation, from which no longer any oil separated, were again saturated with muriatic acid, and concentrated by evaporation at a gentle heat. By boiling these liquids too long, there is always a considerable loss of alkaloid, a portion of which becomes oxidized, and separates as a dark resin. The basic oils were rectified repeatedly with water, when more resinous matter was separated. To free them from still adherent ammonia, they were repeatedly agitated with strong solution of caustic potash, and separated from the ammoniacal potash ley by means of a funnel. This operation, which was continued until the oils were perfectly free from ammonia, is accompanied by an unavoidable loss. The next step was to free the bases from the dissolved water, of which they contained nearly half their volume. This was effected by leaving them in contact for several days with fused caustic potash, and frequently agitating the mixture. To be certain of having removed the whole of the water, they were mixed with fresh quantities of dry potash, until the latter was no longer moistened after long standing. The clear liquid was now decanted and carefully rectified. The first two thirds which distilled over consisted of a colourless transparent oil. The last portions, which came over at a higher temperature, were coloured slightly yellow, especially towards the close of the distillation. The colourless and coloured distillates were therefore kept separate; however, the latter were obtained perfectly colourless by repeated rectifications. As the considerable variation in the boiling-point showed distinctly that the substance in question was a mixture of bases, various experiments were made to separate them by fractionated distillation. At 226° F. the liquid began to boil, and a very small quantity of a transparent colourless oil distilled over, which was collected separately. The thermometer now rapidly rose to 248°, and from that up to 266°; at both which points small portions were collected. The boiling-point remained constant for a considerable time between 302° and 311°, and a large quantity of oil distilled over; about an equal amount was collected between 320° and 329°. The boiling points of the last portions which passed over were between 329° and 428°. The products of these different distillations were again rectified, and in this manner oils obtained, the boiling-points of which correspond more closely with those at which the thermometer remained longest stationary in the first distillations.

Although these different bases varied so considerably in their boiling-points, they were very similar in other respects. They are colourless, transparent oils, of strong refractive power, lighter than water, and possess the peculiar, pungent, slightly aromatic odour characteristic of this class of compounds. The odour adheres to the hands and clothes for a very long time, and is strongest and most pungent in the more volatile bases; they have a hot taste, which is not disagreeable in the dilute state, and resembles oil of peppermint. The bases which distilled over at a low temperature are tolerably soluble in water, and decidedly more soluble than those with higher boiling-points. They all dissolve in every proportion in alcohol and ether, and exhibit a very powerful alkaline reaction upon curcuma and reddened litmus-paper. A glass rod, moistened with muriatic acid and held over them, produced copious white fumes. They neutralize acids completely, and form in general crystalline salts, and likewise crystalline double salts with the chlorides of platinum, gold, and mercury, which are about as soluble in water as the corresponding ammonia compounds. Some of the platina salts crystallize in beautiful four-sided prisms. The salts of the bases with higher boiling-points were, however, frequently contaminated with a brown resin, and could not be obtained well crystallized; the same was the case with the salts of gold. They precipitate, like ammonia, salts of iron and copper; and the precipitates of the latter dissolve in an excess with a beautiful blue colour. They were kept in closed bottles, which, however, were opened pretty frequently, but nevertheless remained transparent and colourless. When, however, they are exposed for some time to the light, the bases with higher boiling-points acquire a deep yellow colour. The bases are readily oxidized. When treated with nitric acid, they are quickly converted into yellow resins, without, however, nitropicric acid being produced. With chloride of lime they are converted into brown resins, without a trace of aniline being detectable. When the bases were boiled in a retort for a few minutes they gradually became coloured, although what distilled over was as colourless as before. When the distillation was terminated, a small quantity of dark brown resin was left in the retort.

I will now add a few very imperfect details, in order to give an idea of the nature of these bases. I regret that the difficulties I have hitherto met with in procuring larger quantities have prevented me from submitting them to such an accurate examination as they deserve. I hope, however, to be able to accomplish this.

The base, which distilled over between 302° and 311°, furnished:—

Carbon.....	74.60	74.78	10=740.0		74.98
Hydrogen	8.18	7.77	6	75.0	7.49
Nitrogen.....	..	..	1	175.2	17.53

On mixing the anhydrous base with muriatic acid, considerable heat was evolved. The muriatic compound was very soluble in water, and crystallized on evaporation in transparent prisms. It formed similar crystalline salts with sulphuric and nitric acids. The platinum salt was readily soluble in minute four-sided prisms of an intense yellow colour. It was somewhat less soluble in water than the corresponding ammonia compound. It was purified by repeated crystallization from water, by which it was freed from a small quantity of a resinous matter. It furnished 34.72 and 34.60 per cent. platinum; the formula $C_{10}H_6N$, HCl, $PtCl_2$ requires 34.50.

A double salt was immediately formed on mixing chloride of gold with a muriatic solution of this base. It crystallized in beautiful light yellow needles, which dissolve very readily in hot water, and again separate on cooling.

It is readily seen that this base, the probable formula of which is $C_{10}H_6N$, approaches very closely in its composition to nicotine, and in its properties to picoline, the base discovered by Dr. Anderson in coal-tar. The formula of nicotine is $C_{10}H_8N$. The boiling-point of the new base is higher than that of picoline, and its solubility in water much less. Dr. Anderson observes respecting picoline, that it dissolves in every proportion in water; the new base requires at least from six to seven parts of water for solution. It is lighter than water; the odour is peculiar and slightly aromatic; the taste burning and somewhat like oil of peppermint. It keeps perfectly colourless in closed vessels not exposed to light. When heated it quickly takes fire, and burns with a bright smoky flame.

To obtain an approximate idea of the percentage composition of the other bases which accompanied the preceding one, three of the different distillates were submitted to analysis. I. is a substance which boiled between 320° and 329°; II. is a substance which boiled between 329° and 338°; and III. is a substance which boiled between 392° and 410°:—

	I.	II.	III.
Carbon.....	74.08	75.42	75.63
Hydrogen ..	8.06	8.52	8.73

It is remarkable that the amount of carbon and hydrogen does not vary more, whilst the boiling-points of these bases (or basic mixtures) are so far apart. They all form double salts with chloride of platinum and gold. However, those with higher boiling-points are usually contaminated with more or less resin. They all appear to possess equally strong basic properties.

I selected for a second experiment the seed of Linum usitatissimum, or rather the expressed oil cake, as a type of that class of plants in which the starch which the Gramineæ contain is replaced by oil, as, for instance, in Papaver somniferum, Brassica rapa, Sinnapis, &c. They all contain very large quantities of albumen. The oil cakes were broken into small fragments, and subjected to distillation in the previously-mentioned cylinders. The quantity operated upon was rather more than two cwts. The oil cakes yielded, as was to be expected, comparatively much less liquid products than the beans. The odour was peculiarly disagreeable. The distillate consisted of acetone, acetic acid, and a large amount of tar and empyreumatic oils. The quantity of ammonia was likewise very considerable; but unfortunately the amount of organic bases was much less than I had expected, and perhaps scarcely a third of that I had obtained from the beans. This may perhaps be ascribed to the much higher temperature required for distilling the oil cake; as, from its containing less water, the heat was raised higher than in the case of the beans. Now, since all these volatile alkaloids experience decomposition at a high temperature, with disengagement of ammonia, I think I am justified

in assuming that in this, and in many other cases, a large portion of the bases which would have been produced at a lower temperature are either not formed or immediately destroyed after their production. The large amount of ammonia and the small quantity of organic bases may be explained in this manner.

The bases obtained from the oil cake were separated and purified in the same manner as stated in reference to the bases from the beans. They also consisted of a mixture of basic oils, distinct from those obtained from fossil coal or bones, as they contained neither aniline or quinoline. They likewise differed in their odour from those obtained from beans, which in other respects they very much resembled. Their basic properties are quite as decided, and they form similar salts. It is, therefore, highly probable that some of the bases of these two series are identical.

Wheat.—The product resulting from the distillation of wheat-flour was different from the two others and very strongly acid, arising from the large quantity of acetic acid produced from the considerable amount of starch in the seed. Acetone and pyroxylic spirit are likewise present in considerable quantity. The empyreumatic oils were of a less disagreeable odour than those of the preceding distillations; there was a pretty considerable amount of ammonia present, but the quantity of organic bases was small beyond expectation. They contained neither aniline nor quinoline, and appeared in their general properties to be quite similar to the preceding series; they, however, appeared to be of more volatile nature, as they distilled over at a far lower temperature.

Turf.—The material operated upon was from the neighbourhood of Glasgow; the products of the distillation were nearly neutral, owing to the large amount of acetic acid. There was, moreover, much acetone and pyroxylic spirit. The crude distillate was supersaturated with muriatic acid, and boiled to expel acetone and pyroxylic spirit, which held in solution a portion of the tar. Upon cooling, the tar separated on the surface as a semi-solid crust, and was easily removed. The clear liquid was then saturated with carbonate of soda and distilled. The ammoniacal liquid which came over contained a considerable amount of organic bases, which floated on the surface in the form of an oil. These were freed from ammonia, and purified as above described. I hoped to find aniline in this mixture; but it appears to contain neither aniline nor quinoline. They bore great resemblance to those of the preceding series; but whether they are identical with them or not I am at present unable to tell.

Wood.—I was enabled to examine, through the kindness of Mr. Turnbull, considerable quantities of the crude products of distillation of beech, oak, ash, and other hard woods. The stems and thicker branches of the trees were exclusively used. I was much astonished to find that these liquids contained scarcely a trace of ammonia and of other organic bases. It appears, therefore, that the stems of trees are almost perfectly free from nitrogenous matter, in which respect they form a remarkable contrast to turf, a circumstance which appears to me capable of throwing some light upon a very interesting question, the origin of fossil coal.

[*To be continued.*]

MEMOIR ON COFFEE.

By M. PAYEN.

Payssé, Chenevix, Cadet de Vaux, and Cadet de Gassicourt, examined the composition of coffee, without isolating any of its proximate principles; Runge discovered and Robiquet studied caffeïne, a crystallizable nitrogenous substance. Robiquet observed in coffee two fatty substances, one of which appeared to him analogous to the resins.

A skilful German chemist, Rochleder, examined, in 1844, the fatty matters of coffee; he extracted from it palmitic and oleïc acids; he showed that coffee does not contain resin; and he noticed the presence of a nitrogenous substance—legumine. The resisting tissue appeared to him to be formed of one of the ligneous substances which I have made known.

Notwithstanding the efforts of the scientific men I have named, the chemical knowledge attached to this important product left much to be desired. I have endeavoured to extend it.

ORGANOGRAPHIC EXAMINATION.

The resisting mass, of a horny appearance, forming the perisperm or endosperm of these berries freed from their pericarp, presents, under the microscope, a tissue of juxtaposed cellules, with thick sides indented with irregular cavities, communicating with one another by small openings.

The thick sides, disaggregated by sulphuric acid in presence of iodine, acquired the blue colour which denotes cellulose, then formed a gummy solution indicating dextrine. The agglomerated organic corpuseles, coloured orange by these reagents, showed, with their nitrogenous composition:—1. A peripheric cuticle covering, in all their folds, the surfaces of the perisperm. 2. The spongy nitrogenous substances filling the epidermic cellules, and containing oleïform matters. 3. In the more internal cellules, analogous granular bodies, containing fatty substances. 4. Lamelliform membranes, injected with nitrogenous matters, in the intercellular meati.

PROXIMATE ANALYSIS.

The coffee should first be reduced to a powder by means of a mill or a pestle and mortar; it is afterwards exhausted with ether in a displacement and continuous distillation apparatus.

The ethereal solution gives, on approaching to dryness, a fatty matter, which may be separated by washing with boiling water.

The aqueous solutions, mixed, leave a brown or fawn coloured residue, which, treated with anhydrous alcohol,* yields, after evaporation, a crystalline deposit, which, washed twice in cold alcohol, dissolved twice in boiling alcohol, and crystallized, gives caffeïne in distinct, white, brilliant prisms.

Pure caffeïne thus obtained for the first time directly is fusible by heat and volatile without residue; its vapours, condensed, reproduced crystals sublimed in colourless and diaphonous prisms. It gave, in four analyses, numbers differing but little from the admitted composition. Its elementary composition and its equivalent weight, hitherto undetermined, would correspond to the following formula:—

C_{16}	96	or	50.855
H_{10}	10	"	5.085
N_4	56	"	30.000
O_3	24	"	14.060
	186		100.000

Coffee exhausted by ether was very carefully washed with alcohol of 0.60; the solutions, added together, were of a rather syrupy consistence; three times their bulk of alcohol was added to them. The liquid separated into two parts; one was viscid and deposited, the other was very fluid. The latter, which contained the greater part of the new crystallizable compound, was decanted. It may be detected by putting a small quantity of the solution in a tube, and adding a drop of ammonia: the yellow colour verging on green, and that becoming gradually more intense, is a certain indication of this fact; it led to the process about to be described, and also served as a guide in the ulterior operations, when, having mother liquors to treat, it was necessary to eliminate, by means of alcohol, foreign substances from the compound just obtained. To take from the different precipitates a portion of the crystallizable compound, it is sufficient to dissolve them in a small quantity of water, then to precipitate it again by means of alcohol of 0.85 or 0.90; the supernatant liquor removes from the solution the substanec sought.

All the alcoholic solutions were distilled on a sand-bath. The syrupy residue was diluted with 0.25 of its bulk of alcohol at 0.90. Put into a cool place, it gave, after twenty-four or forty-eight hours, granular crystals, which were collected in a filter, and purified with cold alcohol at 0.65; they were washed on a filter with alcohol of 0.70 to 0.85.

They were then redissolved to saturation in alcohol of 0.6, the mixture being heated in the sand-bath. Cooling gives abundant and almost pure crystals; these are prisms grouped in spheroids by the reunion of one of their ends in a common centre. The purification is finished by redissolving in alcohol and recrystallizing twice. Finally, it is allowed to drain, and dried *in vacuo* at 230° F.*

PROPERTIES AND COMPOSITION OF THE CRYSTALLINE SUBSTANCES OF COFFEE.

The properties manifested by certain reactions on this substance could not be comprehended without first knowing its composition.

The colourless principle of the rich green coloration resides in the acid, which I call, for this reason, chloroginic acid. The crystallizable compound, or natural salt of coffee, is a double chloroginate of potassa and caffeïne. If it be rubbed when it has just been dried at 212° F. on a warm sheet of paper, it is electrified so as to adhere to the blade of a knife presented to it, and so as to maintain the form of long, bulky flocks.

When exposed to heat it undergoes no alteration up to 300° F.; but towards 365° F. it fuses, develops a beautiful yellow colour, boils, swells up to such an extent as to occupy five times its original space, and remains spongy, yellowish, solid, and friable. When heated to 450° F. it becomes brown; it is then partially decomposed. The vapours which are disengaged from it give, in condensing, crystals of caffeïne in needles. If it be heated further, the brown colour becomes deeper, a fresh liquefaction takes place, abundant alkaline vapours are exhaled, the mass swells up again, so as to assume four times its bulk, or twenty times that of the crystals employed. The very light charcoal thus obtained has an iridescent surface.†

It is, doubtless, to the presence of the chloroginate interposed in the cellulose of the perisperm that the swelling of coffee berries in roasting must be attributed.

This double salt is very slightly soluble in anhydrous alcohol, even with the aid of heat.

Its saturated solution in alcohol of 95°, made with the aid of heat, allows it to crystallize, by cooling, in prisms radiating from common centres. Being more soluble in alcohol of 85°, its crystallization from it on cooling is more abundant: the solubility increases with the dilution of the alcohol. Pure water dissolves still more of it, and this solution, saturated with heat, cools in the form of a mass. The cold solution, evaporated in a capsule, gradually separates a crown of very fine crystals in groups. The aqueous solution, even during crystallization, is decomposed in the air, becoming first yellow, and then greenish-brown.

Crystals of double chloroginate, gently heated in contact with potassa, become of a vermilion or orange red; heated further, the mixture fuses, takes a yellow colour, disengages abundant ammoniacal vapours, becomes brown, &c.

* The portion of the aqueous extract which does not dissolve in anhydrous alcohol contains a small quantity of a new crystallizable compound of legumine and another nitrogenous matter.

* Throughout the processes which have for their object the extraction and purification of the new crystallizable compound, distilled water, free from air and traces of ammonia, must be used; the same water must be used for diluting the alcohol to the various degrees required; finally, it is necessary to keep the solutions *in vacuo* or under receivers, with shallow vessels of sulphuric acid.

† The phenomena here pointed out were observed in operating on 1 decigramme of salt in a tube 5 millimetres in diameter and 0m. 12 in length.

Heated with monohydrated sulphuric acid, the natural salt of coffee develops an intense violet colour and a bronzy pellicle. Hydrochloric acid produces analogous phenomena; under the influence of nitric acid an orange-red colour is manifested.

In solutions of the double chloroginate, acetate of lead gives a flocculent, pale greenish-yellow. The tribasic acetate produces a precipitate of similar form, but of a pure yellow colour. Nitrate of silver alone does not produce any change, but, previously mixed with a very small quantity of ammonia, it gives a yellow colour which inclines to brown; the liquor becomes turbid; a pellicle of reduced metallic silver very soon appears on the surface, and gradually extends to the sides of the vessel.

The proximate analysis of the double salt may be performed by several processes; the potassa is determined by incineration, and is represented by 0.11 of carbonate, or by the conversion of this salt into sulphate.

The compound dissolved and treated by a quantity of sulphuric acid equivalent to the potassa, then evaporated in contact with powdered marble, gives sulphate of potassa mixed with an acid chloroginate of caffeïne. Alcohol removes this organic compound whose acid may be precipitated by subacetate of lead. The caffeïne is extracted from the supernatant liquor, by washing the residue with cold alcohol, and treating what remains with hot alcohol; the latter, on cooling, deposits caffeïne in crystals.

The chloroginate of lead may also be obtained either by precipitating the alcoholic solution of the normal salt with tribasic acetate of lead and washing the precipitate, or by triturating the same salt, without heat, with an excess of protoxide of lead and water. In the latter case, the potassa left in the mixture renders the chloroginate of lead soluble, forming, doubtless, another double compound; but the disunion of the parts may be effected by a current of carbonic acid introduced into the filtered liquid. This solution retains the potassa and caffeïne.

The latter may be extracted by evaporating to dryness, washing the residue with cold alcohol, then dissolving the caffeïne in boiling alcohol, which, after filtration, makes its appearance, filling with its crossed needles the entire height of the liquid.

A fourth means, which is much longer, of extracting the caffeïne from the double salt consists in producing an alteration of chloroginic acid under the combined influences of water, air, and ammonia. One gramme of the natural compound is dissolved in ten cubic centimetres of water; two or three drops of ammonia are added, and it is placed in a flat capsule under a bell glass in which the air is very slowly renewed. The yellow, green, and bluish-green colours succeed in twenty-four hours; then the mixture acquires a brown tint. A little water is occasionally added to compensate for evaporation. After twenty or thirty days the conversion is finished; it is evaporated to dryness, and a very deep brown residue is obtained, which, detached in scales, powdered, and treated with boiling anhydrous alcohol, first dissolves and then crystallizes the caffeïne by cooling. The alteration of the double salt by heat, carried only far enough to turn the swelled-up matter slightly brown, also enables us to extract a considerable portion of the caffeïne by means of boiling anhydrous alcohol.

EXTRACTION AND PROPERTIES OF CHLOROGINIC ACID.

Chloroginate of lead, completely purified by washing with boiled distilled water, and decomposed by a current of sulphuretted hydrogen, gives a solution which, rapidly evaporated, permits a confused crystallization of chloroginic acid.

This acid, purified by small quantities of anhydrous alcohol, is white, soluble in anhydrous alcohol, more soluble in dilute alcohol, very soluble in water, and difficultly crystallizable. Its aqueous solution, almost saturated at the boiling temperature, crystallizes only very slowly in microscopic prisms radiating from common centres, presenting, after twenty or thirty days, numerous agglomerations of spherules of one or two millimetres in diameter.

Chloroginic acid dissolved in water has a very acid reaction; it powerfully reddens litmus-paper; it is the active principle in the different colourings noticed above in the natural salt of coffee. Heated in a tube, it fuses, turns yellow, boils, and leaves a thin shining layer of charcoal; its vapour condenses into a brown liquid, which, rapidly heated, leaves a very thin iridescent layer of charcoal.

The elementary analyses of chloroginic acid, of the double chloroginate of potassa and caffeïne, and of chloroginate of lead, gave the following results:—

Chloroginic Acid.

Carbon	56.0
Hydrogen	5.6
Oxygen	38.4
	100.0

Chloroginate of Potassa and Caffeïne.

Carbon	50.74
Hydrogen	5.38
Nitrogen	9.12
Potassa	7.50

Proximate Composition of the Double Chloroginate.

Chloroginic acid	63.5
Potassa	7.5
Caffeïne	29.0
	100.0

Proximate Composition of Chloroginate of Lead.

Chloroginic acid	40.0
Oxide of lead	60.0
	100.0

Equivalent Weight of Chloroginate Acid.

C_{14}	84
H_8	8
O_7	56
	148

Equivalent Weight of Chloroginate of Lead.

Acid	148
Oxide 2 Pb O	224
	372

Undoubtedly, a greater number of analyses of the various compounds are required in order to establish definitively the composition and formulæ of chloroginic acid and of the chloroginates; but the following facts will remain demonstrated, independently of any further verification:—

1. A portion only of caffeïne is in the free state in coffee; it may be extracted directly, without heat, and very pure.

2. Caffeïne fulfils a basic part in the composition of the natural double salt.

3. The alterations of the organic acid, whether spontaneous or produced by an elevation of temperature, set caffeïne at liberty, and leave, combined with the potassa, a brown acid, the product of the ultimate transformation.

4. The double salt pre-exists in the normal state in the perisperm of coffee berries.

5. Among the curious properties of chloroginic acid, the remarkable power which it possesses of developing a very intense green colour adds interest to the discovery of the crystallizable compounds which its rapid and variable transformations had hitherto caused to be overlooked.

AROMATIC ESSENCE OF COFFEE.

Among the properties which distinguish our aliments, one of the most important—the aroma which these substances exhale—performs a great part in the phenomena which precede and accompany the acts of nutrition; it guides our senses, and, however fugitive or diversified it may be, it still leaves an impression on the memory capable of influencing our selection in the presence of many kinds of food.

M. Chevreul, in a special report, has shown how we should take account of the aroma and taste of broth, and by what means they may be developed.

It is among the volatile acids, the etheriform or alcoholic compounds, the different substances carried away by the ammoniacal and aqueous vapours, and still more generally in the essential oils, that the more or less complex causes of odours reside, and, in particular, that of the aroma belonging to alimentary substances.

Coffee contains aromatic essences, which the fat oil obtained by the processes described above powerfully retains; the aromatic properties are modified by torrefaction, however slight.

It was in this state that it was desirable, with the view of applications, to extract, study, and weigh these odoriferous bodies. In the hope of attaining this object, and availing myself of the skilful co-operation of M. Poinsot, I made a great number of distillations of several commercial kinds of coffee, roasted at different degrees, in glass apparatus, fractioning the products; the latter were condensed at several temperatures, from 194° F. to from 4 to 6 below the freezing point of water.

The infusion obtained by means of warm water poured on ground coffee, in the proportion of one quart of water to 100 grammes of coffee, was put into the first flask of the apparatus; after two hours' boiling it did not retain any agreeable odour; the first receiver, whose temperature was gradually raised by the condensation of the vapour from 77° F. to 194° F., contained distilled water occupying 0.1 of the bulk of the infusion. On this water, which was of a slightly yellow colour, floated a few drops of a concrete white essence; this essence, like the rest of the distilled liquid, was almost entirely deprived of the agreeable aroma, whose traces might be confounded with the odour developed by several animal matters altered by boiling.

The second receiver, maintained at the temperature of 77° to 86° F., had received scarcely 0.01 of the bulk of the infusion in the form of a liquid, which was distilled when the temperature of the first receiver had been allowed to rise to 194° F. This liquid, on which floated minute quantities of concrete essence, exhaled an agreeable aromatic odour, resembling that of coffee itself, but so intense that a few drops of this water were sufficient to communicate to a cupful of milk or any inodorous liquid the agreeable aroma of coffee.

The particles of concrete essence were not the source of this aroma; for, isolated and washed, they did not appear to retain any; thus the aromatic matter was entirely soluble in water.

The third receiver, cooled several degrees below the freezing point, condensed a few drops of water exhaling the mixed odour of coffee and of the pyrogenous hydrocarbons; the latter odour existed especially in the fourth receiver, equally cooled, but whose sides had condensed only traces of moisture; the same empyreumatic odour predominated even in the aëriform matters which issued from the fourth receiver. The presence of carburetted hydrogen in the gases was proved by passing them into a tube with bulbs full of concentrated sulphuric acid. This acid acquired a deep brown colour, and a deposition of carbonaceous matters took place when the acid was diluted with water.

The presence and proportions of the carbon in these gases may be determined by directing them through a tube for elementary analysis filled with binoxide of copper, and collecting the carbonic acid disengaged.

The proportions of the very volatile empyreumatic carburets with a disagreeable odour increased more and more when the roasting of the coffee had been carried from that which corresponds to a loss in weight of 0.18 to that which is equivalent to the loss of 0.25 beyond.

It is evident that it is possible to isolate the residue and the products of an infusion of coffee so as to retain in a form reduced to a bulk of $\frac{1}{100}$th the greater part of the aromatic principles. These latter are complex; two odoriferous essential oils may be extracted from them. It is sufficient for that purpose to strongly agitate the

distilled water which contains them with 0.20 of its bulk of ether; it is left to repose for a quarter of an hour, when the supernatant ethereal solution is removed with a pipette. This operation is repeated four times, and the evaporation of the ether leaves an orange-coloured oil, the very powerful odour of which partly resembles the aroma which prevails more or less in all varieties of coffee. Ten grammes of the water distilled from Mocha coffee gave one centigramme of this oil, taking account of the waste during the evaporation of the ether, which waste may be determined by dissolving this essence a second time in ether, and weighing again after a second evaporation. This essential oil was formed of two parts; one, less volatile and less fluid, appeared to result from the alteration of the oil possessing the most agreeable aromatic odour. There remained in the water, agitated with ether, an ethereal solution of the second essence, endowed with a very sweet aromatic odour; its proportions, small in the inferior qualities, but large in Mocha coffee, appear to constitute the principal differences between the commercial qualities. It may easily be extracted by placing pieces of chloride of calcium in the first two receivers; the solution of the chloride raises the temperature in these vessels as the vapour condenses in them. A third receiver, surmounted by a tube filled with chloride of calcium, cooled to 68° F., retains, with the saline solution, almost all the aromatic essence which is extracted by means of ether. The total weight of the essence thus obtained amounted at most to two ten-thousandths of the weight of the coffee, and this may be understood, since one drop of this oil diffused over a room a strong odour of coffee.

The variable qualities for a long time observed in the coffees of commerce are owing chiefly, doubtless, to the varieties cultivated, and to the habitual or accidental circumstances of vegetation, such as exposure, soil, locality, the care taken in cultivation, and the atmospheric conditions. It would be interesting to endeavour to determine the influences of these different causes on the qualities of the product.

I devoted attention to discovering the principal differences between two commercial varieties, concerning the origin of which I could not have the least doubt—Martinico and Mocha coffees.

The first is ordinarily in large berries, presenting a depressed face; some berries, rolled in ellipsoids, proceeding from fruits of which one of the ovules was absent. Some berries, still more rare, have a slightly angular form, dependent on the presence and the mutual pressure of three ovules in the same fruit.

Mocha coffee differs from the foregoing in that its berries have a yellowish-grey colour; they are smaller, their forms more irregular, very generally flattened on the side, which is in contact with another berry in each of the fruits. Some berries only are rounded, because they are found, each separately developed, in a fruit in which one of the ovules is wanting.

Many characters distinguish Mocha coffee from all others; the fatty matter, which is rather more abundant, forms $\frac{13}{100}$th of the total weight; I could separate only two parts having different points of fusion, difficult to determine. It retained more powerfully a portion of the aromatic essence, sweeter, and in greater quantity.

The fatty matter of Martinico coffee, extracted by the same means and exhausted by boiling water, is browner and less fluid; it may be separated into four parts, whose melting points are, respectively, 41, 65, 122, and 194° F. This last part resembles the wax of leaves.

The presence of a waxy matter and the green colour of the berries might depend on the period of gathering and the time at which the barking was performed. In removing the pulp of the fruit when it is full of juice, the perisperm, being quite moist, must undergo in the air certain reactions to which oxygen gives rise: thus the chloroginate undergoes partially the green transformation, the fatty substances are altered, and the essence, less abundantly secreted, may thus be altered and partly escape.

These hypotheses, which agree with the results of analysis, led to the idea that the quality of certain coffees might be improved by allowing them to come to a more complete degree of maturity before the decortication. Perhaps, if a portion of the crop was left to ripen and dry, a quality would be obtained analogous to those mixtures of Mocha coffee with green coffees—of which many people prefer the mixed aroma to the more soft aroma of the pure Mocha. This interesting subject, with observations made in our colonies, might be concluded in France with analytical experiments.

The influence of the period of gathering, and of a particular mode of decortication, seems to me to be manifested also in the results of the preparation of a very peculiar kind of coffee called Yungas in Bolivia. This sort is in regular bulky berries of a yellowish-grey colour. Under these appearances we see only a light envelope in which lies a perisperm of the same form and similarly marked, but which, having shrunk more considerably by desiccation, is much smaller than the berries of ordinary coffees. In order to obtain this kind of coffee, it is gathered and barked very long before maturity. It is a fancy coffee which the Bolivians prefer, doubtless from custom, although it develops less of the soft aroma which characterizes Mocha and several varieties generally esteemed.

In combining the different analytical results, it was found that coffee in the normal state presents as nearly as possible the following composition:—

Cellulose		34
Hygroscopic water		12
Fatty substances	10 to	13
Glucose, dextrine, vegetable acid undetermined		15.5
Leguminc, caseïn (glutine ?)		10
Chloroginate of potassa and caffeïne	3.5 to	5
Nitrogenous organism		3
Free caffeïne		0.8
Concrete essential oil, insoluble in water		0.001
Aromatic essence, fluid, with a sweet odour, soluble in water, and, less soluble, aromatic essence		0.002
Mineral substances: potassa, lime, magnesia, phosphoric, sulphuric, and silicic acids, and traces of chlorine		6.697
		100.000

It would be very interesting to know the special effects in the animal economy of the well-characterized substances which enter into the composition of coffee, and are not found in any of the matters proposed as a substitute for it—what is the action of caffeïne which is so little alterable; of the double chloroginate with a bitter aftertaste, so unstable in the presence of oxygen; and, finally, of the aromatic essences? We hope that our learned practitioners will enlighten us on this point.

But already they have taught us, and the experience of every day confirms it, that coffee, differing from the powerful alcoholic drinks and narcotic vapours which intoxicate and stupefy the senses, seems to unite all that is agreeable in the sensations of both orders, exciting the intellectual faculties.

Supposing that the principal cause of the special effects of coffee does not reside in the agreeable, diffusible aroma, it cannot be doubted, at least, that this property has the greatest influence on the commercial value; for this value is fixed according to the greater or less power, and the sweetness, of the aroma in each variety. Now, if we were to admit for the ponderal quantity of the essence only two thirds of the price of coffee, we should attribute to the principal essential oil the enormous value of 10,000 francs (£400) the kilogramme.—*Annales de Chimie et de Physique*, and *Chemist*.

ON THE ANALYSIS OF SOME SPECIMENS OF HOT AND COLD BLAST IRON.

The specimens of iron of which the following are analyses were kindly furnished by Richard Smith, Esq., agent to Lord Ward, from the Coneygre iron furnaces near Dudley. The object of the analysis was to show how far the quality agrees with what might be predicated from the composition, and also the difference produced in the composition of the iron by the cold, warm, and hot blast respectively, when smelted from the same or nearly the same materials. The materials manufactured by the hot blast only differed in having a small proportion of an ore richer in iron added to the others, and it is probable that the essential difference in the per centage of silica contained in two, and of the phosphorus in all, is due to the effect of the hot blast; the phosphoric acid, for example, requiring a very high temperature for its reduction. Of Nos. 2 and 4 (see table below), the *hot blast* iron is considered much inferior, being more brittle than the others, and requiring much longer working in the puddling furnace. No. 8 (hot blast) is also considered a very inferior iron; for, although it contains but little silica, a larger proportion of phosphorus enters into its composition. This, however, as well as the warm and cold blast of the same number, is liked by the workmen (puddlers) on account of the yield, they being paid by the quantity produced; and this, as will readily be seen, must be greater than from the lower numbers.

Method of Analysis.—For the determination of the first five constituents, silica, &c., the iron was broken up in a steel mortar until sufficiently small to be readily acted upon by hydrochloric acid and by nitric acid. One portion was weighed for the estimation of the silica, iron, and manganese, and a second portion for sulphur and phosphorus.

Silica, &c.—The first portion of the iron was treated with hydrochloric acid in a sand-bath, until nothing but silica and carbon remained undissolved; it was then evaporated to dryness, strongly heated, and again treated with hydrochloric acid.

The silica thus separated generally contained a little more iron, and was also *intimately* mechanically combined with carbon. It was therefore removed from the filter, and fused with carbonate and nitrate of potash; the silica again, separated in the usual way, was dried, ignited, and weighed. The iron was added to the main quantity in solution, which was then boiled with nitric acid. Ammonia was added to the solution until a faint acid reaction alone remained, when a little succinate of ammonia sufficed to precipitate the iron which remained in solution. The succinate of iron thus separated was filtered off, well washed with cold water and ammonia, dried, ignited, and weighed. It was then moistened again with nitric acid, dried, and ignited until the weight became constant. The solution was then evaporated, sulphuret of ammonium added to it, and the whole allowed to stand for twelve hours; the sulphuret of manganese was then filtered off, and washed with water containing sulphuret of ammonium. The sulphuret was converted into sulphate, dried, ignited, and weighed. The solution from which the sulphuret of manganese had been separated still contained a little more sulphuret of manganese, which was proved by evaporating it to dryness, igniting, and driving off the ammoniacal salts, when the manganese was left in the form of sesquioxide (Mn_2O_3). This was converted first into protochloride of manganese, and then into sulphate of the protoxide, and added to the first quantity.

Sulphur and Phosphorus.—The second portion of iron being treated with fuming nitric acid, and warmed, quickly dissolved: the silica was

separated in the usual manner. Chloride of barium was then added to the mass, redissolved in hydrochloric acid, and, after standing for twenty-four hours, the sulphate of barytes was separated. The excess of barytes was then removed by sulphuric acid, and a sufficient quantity of tartaric acid mixed with the solution to prevent the precipitation of iron, when ammonia was added in *excess*. Sulphuretted hydrogen was then passed through the solution, until all the iron was precipitated as sulphuret of iron, and being allowed to stand warm for twelve hours, until it became of a bright yellow colour (sulphuret of ammonium being present in excess), the sulphuret of iron was separated, and well washed with hot water containing sulphuret of ammonium. The filtered solution was evaporated to dryness, carefully ignited so as to expel the ammoniacal salts, and then burn away the tartaric acid. The residue which remained in the platinum dish consisted of phosphate of ammonia (with generally a little impurity). It was fused with an excess of carbonate of potash and soda. The fused mass was treated with boiling water, which dissolved nearly the whole of it. Hydrochloric acid was added in excess to the filtered solution, which was then boiled. The phosphoric acid was precipitated by sulphate of magnesia and an excess of ammonia, with the usual precautions. From the quantity of ammonio-phosphate produced the phosphorus was calculated. It was attempted in the first analysis to separate the iron without the use of tartaric acid, by passing sulphuretted hydrogen for a long time through the precipitated peroxide of iron (ammonia being in excess) at a high temperature, but more phosphoric acid was several times separated from the same portions of iron by the process described.

Nitrogen being detected in minute quantity in several of the specimens by Varrentrapp and Will's process, it was at first thought necessary to determine it in all; but the extremely small quantity found in others, as well as the great tediousness of reducing the iron to powder, induced the analyst to relinquish its estimation.

Carbon was determined by grinding in an agate mortar about thirty grains of filings of the iron (obtained by using one of the *hardest* Sheffield files, which itself loses but a very minute quantity in the process), with a portion of *pure white* sand (previously treated with nitric acid, &c., to destroy any traces of vegetable matter) until the whole was reduced to a perfectly impalpable powder. *Chromate of lead* and *oxide of copper*, with chlorate of potash, were both used in the process of analysis; the preference, however, was given to the former, as affording, in several trials, a greater per centage of carbon.

ANALYSIS OF TWELVE SPECIMENS OF CAST IRON FROM THE FURNACE.

Three Kinds:—Cold, Warm, and Hot Blast; Four Qualities of Each—2, 4, 6, *and* 8.

COLD BLAST.

2.

Silica	3.51
Iron	92.98
Manganese	0.49
Sulphur	0.99
Phosphorus	0.47
Nitrogen	—
Carbon	2.31
	100.75

4.

Silica	3.45
Iron	90.61
Manganese	0.91
Sulphur	0.30
Phosphorus	0.41
Nitrogen	—
Carbon	2.19
	97.87

6.

Silica	1.79
Iron	93.53
Manganese	0.95
Sulphur	0.39
Phosphorus	0.31
Nitrogen	0.25
Carbon	2.04
	99.26

8.

Silica	1.37
Iron	95.67
Manganese	0.35
Sulphur	0.36
Phosphorus	0.20
Nitrogen	—
Carbon	1.79
	99.74

WARM BLAST.

2.

Silica	3.09
Iron	92.45
Manganese	0.54
Sulphur	0.57
Phosphorus	0.40
Nitrogen	—
Carbon	1.96
	99.01

4.

Silica	2.89
Iron	91.82
Manganese	0.91
Sulphur	0.26
Phosphorus	lost
Nitrogen	—
Carbon	2.76
	98.64

6.

Silica	1.33
Iron	94.20
Manganese	0.50
Sulphur	0.20
Phosphorus	0.54
Nitrogen	—
Carbon	2.11
	98.88

8.

Silica	1.57
Iron	95.08
Manganese	0.79
Sulphur	0.45
Phosphorus	0.38
Nitrogen	—
Carbon	2.28
	100.55

HOT BLAST.

2.

Silica	5.14
Iron	90.76
Manganese	0.79
Sulphur	1.07
Phosphorus	0.51
Nitrogen	trace
Carbon	2.87
	101.14

4.

Silica	5.06
Iron	91.30
Manganese	0.69
Sulphur	0.28
Phosphorus	0.55
Nitrogen	—
Carbon	2.99
	99.67

6.

Silica	1.57
Iron	94.31
Manganese	0.79
Sulphur	0.20
Phosphorus	0.50
Nitrogen	—
Carbon	1.82
	99.19

8.

Silica	1.34
Iron	95.64
Manganese	0.39
Sulphur	0.33
Phosphorus	0.71
Nitrogen	0.10
Carbon	1.59
	100.10

METHOD OF TESTING OPIUM.

By M. A. GUILLIERMOND, of Lyons.

The process hitherto used for testing opium being very long and complicated, M. Guilliermond proposes the following in place of it:—

Take 15 grammes of the opium to be tested. After having cut it in pieces, mix it in a mortar with 60 grammes of alcohol at 160° F., and strain it through linen, to separate the tincture; press out the residue, and operate on it with 40 grammes of fresh alcohol at the same degree; mix the tinctures in a wide-mouthed bottle, in which are 4 grammes of ammonia. Twelve hours after the morphine will be spontaneously eliminated, accompanied by more or less narcotine—the morphine covering the interior of the vessel with coloured crystals, large, and feeling like sand; the narcotine crystallizing in very light, small, white, and pearly needles. Wash these crystals with water, either through a filter or linen, to free them from the miconate of ammonia which they contain. After this the narcotine may be separated from the morphine by decantation in water, which will only remove the lightest part of the narcotine.

M. Mialhe has modified this plan of separation, and prefers washing five or six times with four or five grammes of ether. This washing, performed by triturating the already pulverized crystals, leaves the morphine, which must then be dried and weighed.—*Comptes Rendus.*

PHARMACY IN HUNGARY.

The pharmaceutical reform which has made so much progress in the north of Germany has not yet extended its beneficial influence into Austria. In this country the pharmaceutists are still almost completely dependent on the medical men, and the latter appear to have been even encouraged by the local authorities in the exercise of arbitrary and despotic conduct, which they have fearlessly indulged in towards the pharmaceutical body. Thanks to the liberty of the press which was granted in the course of last year, and to the courageous efforts of some of our brethren who asserted the rights of the body, the Government has put an end to the most flagrant of the acts of injustice to which the pharmaceutists were previously exposed. Yet, although the condition of the pharmaceutists has been considerably ameliorated of late, much still remains to be done, especially in those parts of the country where the Imperial Government cannot sufficiently exercise its vigilance with reference to the numerous abuses which continue to exist.

In Hungary pharmacy is really in a hopeless condition. One of the principal causes which have contributed and still contribute to lower the pharmaceutical profession is the existence of too great a number of pharmaceutical establishments. A second cause of the great depression of the state of pharmacy in Hungary is the very small amount of remuneration obtained by its practice. But the latter condition has been an

inevitable consequence of the former. We may give the following case by way of example :—

In the circle of Guns, in Eisenburg, the population of which is at most 50,000, there are thirteen pharmaceutists, which makes an average of one to every 4,000, and in the capital of this circle, a town of about 6,000 inhabitants, there are two pharmaceutists. Several of these establishments are in a miserable condition, having neither stove, pans, press, or distillatory vessels. They are frequently without some of the most important drugs, and yet they undertake to dispense physicians' prescriptions. At only one of these thirteen establishments is an assistant kept; the proprietors of all the others are completely tied to their shops. The annual receipts of each of these pharmaceutists is, on an average, only 500 florins (about £54); and it may be said, without exaggeration, that the sale of birds, which in Hungary is practised in connection with pharmacy, constitutes the principal means of support of the proprietors of these establishments.

Now, how is it possible in such cases, where the shops are in so deplorable a state—where the annual receipts scarcely exceed £54—where the pharmaceutist does not possess the necessary means of improving his position, and is hardly able with economy to procure animal food for his Sunday's dinner, how, we say, can a scientific character be maintained? It is not to be wondered at, but, on the contrary, it was natural to expect that the means which have been adopted on three several occasions for the organization of a system of pharmaceutical instruction have proved ineffectual. Besides, if, in spite of the evils to which we have alluded, a scientific spirit was yet maintained among the Hungarian pharmaceutists, the last vestiges of it would speedily be obliterated through the ignorance and arbitrary acts of those in authority.

Thus, for instance, there resides in one of the capital towns a person appointed as a kind of sanitary commissioner, who, possessing no medical degree, after having served in the campaigns of 1805 to 1809, as medical assistant to the army, arrogated to himself the title of doctor, and in 1810 was raised to the position he now occupies. This man, not content with enforcing the law in reference to physicians and surgeons, intermeddles with the affairs of the pharmaceutists over whom he has supervision, and in this capacity his ignorance and his arrogance are often manifested. As is often seen with those who have not regularly studied their profession, this pseudo-doctor changes his system as he would his coat; at one time an allopathist, at another a homœopathist. But there is here hidden a secret motive. Pretending that the pharmaceutists are not capable of preparing his prescriptions, and that, therefore, he can place no confidence in them, he asserts the right of dispensing his own homœopathic and allopathic medicines, thus monopolizing the triple function of physician, surgeon, and pharmaceutist, and yet one of the pharmaceutists in whom this commissioner pretends that he can place no confidence was formerly a legalized pharmacien of Paris, and has laid himself out especially for the preparation of homœopathic medicines.

The superior authorities of the Government, in reply to the numerous complaints of the pharmaceutists, who have been so shamefully supplanted in the exercise of their art, have frequently reproved this false doctor and the magistrate of the town; but these gentlemen have been content to return the communications, and have carried effrontery to such a point that the magistrate has not hesitated to declare in public, "although the Government may send a thousand orders we will act as we please." Can such things be credited?

About the middle of last year a pharmaceutist residing in the circle of Guns presented a petition to the Royal Government of Hungary, signed by himself and other practitioners of the country, in which the petitioners, in claiming the redress of their grievances, propose at the same time divers measures to be adopted for the amelioration of their profession. This petition produced no effect, a result which may be partly ascribed to the confusion created by political changes. It nevertheless gave rise to the abolition of the practice of visiting the shops of pharmaceutists.

The different nationalities which subdivide Hungary still exercise a fatal influence in preventing unity among the pharmaceutists. The Magyars and the Germans, respectively, sympathize only with those of their own nation. It is melancholy to see such trifling questions cause dissension among our Hungarian brethren, who, above all things, ought to understand that their welfare depends upon union and concord. They have only to look to the scientific movements which have taken place among the pharmaceutists of Germany, Belgium, France, and other European countries, to be convinced of this great truth. Individual efforts will never be productive of important results; it is only by the combination of the different members of the body that success can be ensured to the just demands for redress.

There can be no doubt that the political dissensions which still prevail in Hungary and in Austria have contributed in preventing the pharmaceutists from obtaining redress for their well-founded complaints. We may hope that in Hungary, when civil troubles have given place to a beneficial peace, the Government will seriously give its attention to the domestic interests of the country, and introduce into the organization of the pharmaceutical body those reforms which are so imperatively called for.—*Journal de Pharmacie d'Anvers.*

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THE CHEMICAL TIMES.

SATURDAY, OCTOBER 20, 1849.

THE TOBACCO QUESTION.

In our last week's number we passed some comments on the over-much agitated tobacco dispute, in which Dr. Ure has put himself in much unseemly contest with a whole array of British chemists of name and fame.

We say unseemly, not because of any scientific consideration as to the truth or falsehood of the tests proposed by the two contending parties—a matter on which we shall speedily offer an opinion that will at least acquit us of any chemical partisanship—but because of several little *ungraceful* circumstances connected with this dispute well known to the chemical, but not to the general, world.

In the first place, it has always been held amongst professional men as a fundamental rule of their ethics, that if a discrepancy of opinion should exist between two or more of their community, even if their opinions are never so widely different, this difference of opinion, seeming to each individual mutually an error or mistake, should first be discussed between the individuals themselves, with a view of arriving at the truth; if this discussion be ineffectual, it should next be discussed amongst the professional community; and, last of all, very rarely,—some will say never should be,—blazoned forth in the public journals. This latter proceeding is generally harsh, rarely pregnant of truth, and ever repudiated by the most learned, the most considerate, and delicately-minded of professional men. The above is a general objection, as the next is a particular one.

The circumstances as regards time, under which Dr. Ure has founded his objections to the fermentation test, are unfortunate for his own case. Dr. Ure formerly was in the habit of performing many, if not most, of the analyses for the Boards of Customs and Excise. We believe this is no longer so, at least as regards the latter. Herein, then, it is easy to recognise a motive beyond the mere desire of eliminating the truth—a motive which, although we might in some cases and under some circumstances ignore, ought not to pass for nothing in the present case. To us,—to all who know the peculiar relations which exist between Dr. Ure and the respectable portion of the chemical world,—Dr. Ure's mode of parading his discovery before the public is not less indelicate than suspicious. Come we now to chemical facts. The question at issue is this, whether the fermentation test, or a modification of Trommer's test, be the better of the two for the purpose intended, and whether reliance can be placed on either?

To the latter question, which overrides the two former, we feel justified in appending a direct negative. We are convinced that neither of the tests is of any value under the circumstances of the case; and we maintain that the Legislature should require proof analogous to that insisted upon in cases of poisoning, namely, the actual production of the substance of which there is a question. Let the analyst not determine, or affect to determine, the presence in tobacco of either of the varieties of sugar by any indirect test; but let him obtain them bodily, having them palpably before the cognizance of the senses, and the question is at an end.

The Tubular Bridge.—The process of raising the Britannia-bridge proceeds most successfully. The tube is lifted six feet at each end every morning, and during the day it is secured in its new position by brickwork in cement built up beneath it, the timber which is piled beneath it during the actual process of lifting being removed for that purpose. There is now a clear height of eighty-five feet beneath the tube at high water, so that small vessels begin to pass under it, and in a few days it will, in all probability, be at its permanent level, which is 100 feet above high water. The operation is under the superintendence of Mr. Edwin Clark, the resident engineer.

Marine Glue.—Digest from two to four parts of caoutchouc, cut into small pieces, in thirty-four parts of coal-tar naphtha, promoting solution by the application of heat, and by agitation. The solution, when formed, will have the consistency of thick cream; to this add 62 or 64 parts of powdered shellac, and heat the mixture over the fire, constantly stirring it until complete fusion and combination has been effected. Pour the mixture, while still hot, on plates of metal, so that it may cool in thin sheets like leather. In using the cement, put some of it in an iron vessel, and heat it to about 248° Fah., and apply it with a brush to the surfaces to be joined. It is said to make a perfect union of pieces of wood, and it is recommended for use in ship-building;—hence its name.

STATEMENT IN CONTINUATION OF THE ONE PUBLISHED IN THE CHEMICAL TIMES OF OCT. 13, 1849, SHOWING THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE AIR FROM OCT. 7 TO OCT. 13 INCLUSIVE, AS INDICATED BY THE EVAPORATION OF WATER FROM TWO COPPER VESSELS OR SCALES, ONE INSULATED AND THE OTHER NOT. ALSO THE READING OF THE BAROMETER, THERMOMETER, DIRECTION OF WIND, AND GENERAL STATE OF THE WEATHER.

Oct., 1849.	Barometer.		Therm.		Scales.				Wind.		General state of weather.
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Insulated	Non-Insulated	Morning.	Evening.	
7	29.27	29.28	53	55	..	..	..	..	SW.	NE.	Generally overcast all day; heavy rain evening.
8	29.58	29.90	52	45	..	10 N.	..	10	NE.	NE.	Cloudy all day; fine at night.
9	30.00	29.92	40	43	5 N.	..	..	5	W.	NW.	Fine all day.
10	29.83	29.70	39	43	10 N.	10 N.	..	20	SW.	NE.	White frost and foggy morning; fine rest of day.
11	29.52	29.87	47	47	..	5 I.	5	..	NE.	E.	Fine all day.
12	29.52	29.60	47	44	..	..	..	..	NE.	NE.	Cloudy and showers all day; fine evening.
13	29.68	29.85	45	44	5 N.	10 N.	..	15	NE.	NE.	Ditto - - ditto - - heavy rain evening.

The scales continue to show an excess of evaporation from the non-insulated, and the cholera does not appear disposed to leave us. As illustrative of the delicacy of the operation of this instrument, I may observe, that yesterday, when the weather was apparently very fine and healthy, there was an excess of evaporation of 45 grs. from the non-insulated vessel; the barometer fell one tenth of an inch, and the thermometer rose from 45 degrees to 49 degrees in the evening: in the night the rain fell in torrents. Here, then, we have evidence that, whilst crystallization is going on above, *our* atmosphere is deprived of its electricity, and the thermometer rises, increase of temperature and decrease of electricity being one and the same; and this concurrence between the thermometer and the scales is not the exception but the rule. Mr. Glaisher, of the Royal Observatory, Greenwich, has not, however, time to give this instrument even a passing thought, his whole attention being absorbed in his endeavoars to place meteorology on a sound foundation—rather a singular reason to assign for declining an interview when I tell him that his principles are erroneous from first to last, and wish only to convince him that such is the case!

Westminster-road, Oct. 17, 1849.

Franklin Coxworthy, Author of "Electrical Condition," &c.

AGRICULTURAL CHEMISTRY.

ADDRESS BY MR. W. WHITE TO LORD KINNAIRD'S TENANTRY.

My Lord and Gentlemen,—By your lordship's kindness I am placed in a position at once proud and difficult, the former in having an opportunity of addressing so large a body of your lordship's tenants; and difficult, if what your lordship stated, and the reports current in England, relative to the intelligence of Scottish farmers be correct,—and of this I have reason to be satisfied. Little did I think when I had the honour of calling upon your lordship a few days ago that I should have met with so kind and hospitable a reception; that I should, in fact, be placed rather on the footing of an old acquaintance than a stranger; or that the brief conversation we held at our first interview would have led to the pleasure I now experience, of addressing, for the first time, a Scottish audience. To you, gentlemen, is due an apology for the imperfections which may appear in my remarks; and I feel persuaded that every allowance will be extended to me when I state that I am not at present on a lecturing tour, but rather engaged in the disposal of a mercantile article which will, I trust, ultimately prove of great value not only to the agriculturists of the British empire, but to the community at large. I have also in view the acquisition of knowledge relative to agricultural proceedings in Scotland; and I may justly assert that, besides having experienced on all hands uniform and great civility, I have received a stock of information on the modes of cultivation adopted in this portion of the kingdom. In one particular I have been struck with the superiority of Scottish agriculture—I refer to the forwardness of turnip sowing, which here is quite as early as in England, where the climate is more genial. This speaks volumes for your activity and intelligence, and the readiness with which you avail yourselves of the knowledge communicated by practical and scientific men, and of the appliances of art. In the matter of instruction you have certainly had the most favourable opportunities, having for years reaped the advantage of the labours of a gentleman who, by his talents and exertions, has rendered signal service to the cause of agriculture—Professor Johnston. Some parties are disposed to question the boasted benefits of the sciences, and especially that of chemistry to agriculture. Without expatiating upon all the advantages derived from that science by the cultivators of the soil, it may be observed that, though chemistry has not "reduced agriculture to a mathematical science," it has rendered essential service by stimulating the farmer to close study of cause and effect, to examine the character of the soil, the crop, and the manure, and has shown him that upon the application of the knowledge of these, as upon the analogy of cause and effect, depend, in a very great measure, his success in farming. In the course of my remarks this evening I shall have occasion to show you that there does really exist a very close and striking analogy between the crop, the soil (which must be regarded as the pabulum of vegetable existence), and the manure employed to restore the principles of fertilization removed by successive cropping. Matter is subject to two divisions—it is either organic or inorganic, either it holds those principles which constitute vitality or life, and known as organic, or those in which life does not exist, and hence termed inorganic. These are to be found in all plants. There are five or six elements of which all organic matter primarily consists; these are oxygen, hydrogen, nitrogen, carbon, sulphur, and phosphorus. The examination of these elements we will take in order. Oxygen is a highly important element, inasmuch as it constitutes at least one half of the entire physical universe. The vast amount of water which covers so large a portion of this globe consists of eight parts by weight of oxygen with one of hydrogen. The air which the earth is encompassed contains, in its composition, about one fourth of this gas. It also enters largely into many of the salts, alkalis, and acids. Thus it combines with iron in the formation of its oxide or rust. Sand is a compound of silicon and oxygen. Carbonic acid, given off in respiration, consists of six parts of carbon and sixteen of oxygen. The earths, as alumina or clay, and lime consist of oxygen and metallic and other bases. In fact, as before stated, oxygen, which is an inodorous and invisible gas, appears to be the most important and universal element in nature. Hydrogen, also an inodorous and invisible gas, is an element, but in one respect differing materially from that last considered, inasmuch as, instead of supporting combustion, it extinguishes flames. Nitrogen is also a gas, possessing negative properties, being neither a combustible body nor a supporter of combustion; combined with oxygen it constitutes atmospheric air. Oxygen, undiluted with nitrogen, would effect the total destruction of all matter, as a spark let fall upon the most incombustible body (even iron) would ignite it, and you may imagine the universality of such a conflagration. Carbon is another element, the knowledge of which is of great importance to agriculturists. It is obtained in its purest state as diamond, and in an impure state as charcoal, the residuum of the combustion of wood or vegetable matter in close vessels. So strong is the affinity of carbon for oxygen that the combustion of wood in the open air would result in the formation of carbonic acid, the composition of which I have already referred to. With sulphur or brimstone you are familiar. In organic matter it is frequently found associated with hydrogen as sulphuretted hydrogen, a peculiar and highly offensive gas, and well known to the frequenters of Harrogate and other sulphurous spas. Phosphorus, the dreadful acquaintance of the tyro in chemistry, is so highly combustible that it takes fire at the ordinary temperature of the human hand, and communicates to it the most dreadful sensation of burning. Phosphorus is an indispensable element in plants, being generally found in the greatest abundance in those which are the most nutritious. These organic principles are all presented to vegetable life in some form or other, though certainly not in adequate quantity, or in sufficiently perfect condition, through the agency of the atmosphere. For instance, you find oxygen and nitrogen constituting the vast bulk of atmospheric air, which contains also water or aqueous vapour in the proportion of $7\frac{1}{2}$ per cent.; and, such is the beautiful system ordained and regulated by Divine Providence, the proportion of humidity is greatest in the driest season. Nitrogen exists also in the atmosphere in the form of ammonia. In this state it is exceedingly volatile, and frequently passes off in large volumes from ill-regulated manure heaps; thus the farmer manures the fields of his neighbour or those at a distance rather than his own. You will thus see the necessity of fixing the ammonia of the heap by occasionally sprinkling it over with some acid or salt which will convert the ammonia into a non-volatile salt, and thereby prevent its dissipation. For this purpose I would recommend the employment of gypsum or sulphuric or muriatic acid, either the former sprinkled over in the shape of a powder, or the two latter diluted in the proportion of one part acid to 200 or 300 parts water. This, so long as a

rod dipped in muriatic acid, and held over the midden, indicates the passing off of the ammonia by the formation of white fumes. The importance of preserving the ammonia will be rendered apparent when I call your attention to the fact that with every pound of ammonia which evaporates a loss of sixty pounds of wheat is sustained. Carbonic acid, the source of carbon, is chiefly supplied to plants by means of the various processes of combustion, respiration, fermentation, and decomposition of animal and vegetable matter. In respiration, animals, both superior and inferior, consume oxygen and exhale a like volume of carbonic acid, which, in the day time, is inhaled or absorbed by vegetables, so that plants supply nutrition to animals, and animals to plants. Thus is kept up, in a remarkable manner, the balance of creation. The atmosphere, which contains about one part of carbonic acid in a thousand, is found to be in precisely the same condition now that it was 1,800 years ago. This was proved by the examination of a quantity of atmospheric air, discovered in a bottle hermetically sealed, in the ruins of the city of Herculaneum. The first in order of the inorganic constituents of plants is—potash, potassa, or, as it is known in commerce, pearlash, a combination of the alkaline metal potassium and oxygen. The affinity of these two elements for each other is so paramount that, if you place a piece of the metal on water, the latter is decomposed, its oxygen unites instantly with the metal, and the alkali potash is formed. The experiment is a beautiful one, being accompanied with a brilliant flame. Soda, another constituent of plants, is also a metallic alkali from the base sodium. A similar process, substituting sodium for potassium, and warm for cold water, will produce soda. The origin of the two metals has this material difference—potassium is obtained from land plants, and sodium from marine plants or minerals; hence potash is a much more costly article than soda. It would be fortunate for agriculture if potash could be obtained as cheaply and as abundantly as soda. Of the practical application of lime I can suppose you know more than myself, but, probably, you are not aware that it is of metallic origin, being formed of the metal calcium and oxygen. The principal sources of lime are chalk, or carbonate of lime and limestone. The value of lime as an application to the land is threefold:—1st. Chemical, as supplying a direct food to plants. 2d. Mechanical, modifying the physical condition of the soil, giving tenacity to sand, and destroying the excessive adhesiveness of clay. 3d. Also chemical by the decomposition of effete organic matter in the soil rendering it fit for assimilation by the succeeding crop. Magnesia, a compound of the metal magnesium and oxygen, enters into the composition of all cultivated plants, and is found in considerable quantity in wheat, beans, potatoes, and turnips, and hence must be supplied as food to plants, either through the soil or by the agency of manures. Iron, as an oxide, exists in all soils, and generally in sufficient quantity, sometimes in excess, rendering the soil unproductive. When this is the case the land requires the application of drainage, or other expedients for the removal of the superabundance of the obnoxious metal. Manganese is found in such minute quantity, both in the soil and the plant, that very little attention is paid to it; at the same time, as a constituent of several of our cultivated plants, it is requisite that it should be presented as food. Of silica or sand little need be said. Without it the stem or stalk of various plants would be unable to support the weight of the grain or seed, nor would it be possible to obtain perfect plants. In manures, silica should be presented in a form easy of assimilation, as soluble silica, or silicate of potash. This salt is most highly valuable, and should be sought after with avidity in artificial manures. Alumina or clay, of which, no doubt, you think you already know more than sufficient, having frequently to contend with the difficulties inseparable from cold clay soils, is rarely found as a constituent of plants, still its presence is absolutely required in soil to give it sufficient tenacity to fix the root firmly to the place whence it obtains its nutriment, so that, strange as the assertion may appear at the first blush, these are circumstances in which the admixture of clay with the soil would prove the very best manure it could receive, whilst, on the other hand, the application of sand to heavy clay would prove highly advantageous in destroying the excess of tenacity. Chlorine, in its pure state, is a very suffocating and green-coloured gas. It is chiefly found in nature in combination with the metal sodium, as common salt. It appears to me to be a very necessary element in the earliest stages of the growth of plants. In the turnip it is a very important ingredient, and hence I have always recommended the application of salt with turnip manure, and have found its employment of great use in the cultivation of that plant. Sulphuric acid—the oil of vitriol of commerce—consists of 16 parts sulphur and 24 oxygen. There is no cultivated plant from which it is absent. In some, as the turnip, it is found in pretty abundant quantity. Its combination with lime constitutes gypsum, a compound of great value as a direct food of plants, and a fixer of ammonia in the manure heap. Of late years sulphuric acid has been much and advantageously employed in converting bones, naturally difficult of solution, into a very soluble compound known as superphosphate of lime, in which form it has proved a most desirable food for the turnip crop. The last, though not the least, important inorganic constituent is phosphoric acid, a compound of phosphorus and oxygen. This body, which is found generally in the largest proportion in the most nutritious plants, is also discovered in the greatest abundance in the most valuable manures—as farmyard and stable dung, blood, night-soil, urine, guano, and bones, and also in all fertile soils. After ammonia no constituent of manure, whether natural or artificial, should be sought after with so great avidity as phosphoric acid, or its salts known as phosphates.

[*To be concluded in our next.*]

PREVENTION OF MINE ACCIDENTS.

At the meeting of the British Association recently held in Birmingham the attention of the members was invited to a patent apparatus invented by Mr. Fourdrinier for obviating the risks which attend the breaking of the ropes or chains attached to the corves or cages in which the miners descend into and ascend from the pits. Such accidents not only cause destruction of human life, but in shafts which are fitted up with guides according to the most improved practice occasion considerable damage to the shaft fittings. The object of Mr. Fourdrinier's invention is to fix in all such cases the corve or cage (whether loaded with tubs of coal or with its daily and far more precious freight of human beings) firmly and instantaneously to the guides, through the instrumentality of self acting springs, levers, and wedges, attached to the top and forming part of the corve or cage. These come into action when disengaged through the breaking of the rope or chain, that is, in the very instant at which the accident occurs. The apparatus is so admirably contrived that, through the operation of simple mechanical principles, the tightness with which the wedges hold increases in proportion to the increase of weight in the cage. There is in mining operations another source of danger in the liability of the load to be drawn up against the pulleys, through the negligence of the engineer—an accident attended with almost certain death to the men as well as great damage to the shaft. The risk attending such an accident Mr. Fourdrinier also obviates by attaching to the rope or chain a disengaging apparatus, such as that made use of in the pile-driving machine, the corve being, at the moment of disengagement, left affixed to the guides at a certain distance below the pulleys. In this case also the apparatus is self-acting. Mr. Fourdrinier is known to have perilled his own safety (if, indeed, any term implying risk can be employed) in order to test the efficiency of his apparatus. At the Usworth Colliery, in the county of Durham, where it has been in operation since the 16th of April last, it has more than once been subjected to very severe trials, and a number of colliery viewers and engineers, having seen the cage, though loaded with two full tubs, and weighing about two and a half tons, stopped instantaneously upon the disengaging of the rope, have come forward to bear public testimony to the value and completeness of the invention. The apprehension which some persons had entertained with reference to the fall of a portion of the rope, when broken, on the top of the corve or cage, appears to have been removed by a communication from Mr. Elliot, the owner of the Usworth Colliery, which was published in the *Mining Journal* of the 28th of July last. Mr. Elliot there states that in the Usworth Colliery a broken rope, of about 200 fathoms in length, and weighing about thirty-seven cwts., had in that month fallen on a cage top there in use, consisting merely of a three-inch Memel plank, without any injurious result. This he explained by the circumstance that the fall of the rope is distributed over several seconds of time, and that consequently the latter does not acquire the momentum which would be acquired by a mass of the same weight when descending in a compact and solid body. The numerous experiments made at Birmingham with this apparatus afforded the highest gratification to many of the distinguished persons who attended the meeting of the British Association, and Dr. Buckland and many other gentlemen expressed a high opinion of its value. The columns of the *Mining Journal* during the past year show that through the breaking of ropes or chains (the fatal results of which are effectually obviated by Mr. Fourdrinier's invention) eighty-nine human beings prematurely met their end, and this number, it must be observed, is taken from a return gathered from nine counties only in England, and not alluding to a single accident in Scotland. Under such a state of circumstances, the necessity of introducing into their mines either this or some better apparatus (if better can be found), in order to prevent a recurrence of such casualties, cannot be too strongly impressed on the owners of mining property. Measures so easily adopted, and so obviously requisite to preserve the lives of a large number of our fellow-countrymen, ought to need no other recommendation to private interest, philanthropy, or intelligence.

INTRAMURAL INTERMENTS.

The General Board of Health, acting under the authority of the Nuisances Removal and Diseases Prevention Acts, have published in Tuesday night's *Gazette* a series of instructions to the churchwardens and managers of various burying-grounds within the metropolis for the better management of the grounds under their charge, and for regulating the mode of interment therein. The notices addressed to these respective bodies set forth that the General Board of Health, having caused inquiry to be made into the condition of the burial-grounds specified, had found that they were in such a state as to be dangerous to the health of the persons living in the neighbourhood, and that they had accordingly ordered and directed the following rules to be acted upon and executed by the churchwardens, managers, or other persons having the charge and control of the same:—

"1. That the whole surface of the said burial-ground (excepting such parts thereof as are now used as footpaths, or are now covered with flat stones) shall be forthwith covered with quicklime of an uniform thickness of three inches at the least.

"2. That when any portion of the said lime shall be removed for the purpose of making or digging any grave in the said burial-ground, or for any other purpose, such lime shall be replaced

immediately after the filling up of the grave, or the completion of such purpose, and a sufficient quantity of quicklime shall be provided, and from time to time shall be applied, so as to keep the whole of the said burying-ground (except the parts above excepted) covered therewith to the thickness of three inches as aforesaid.

"3. That every grave which shall be made or dug in the said burial-ground shall be covered at the bottom thereof with quicklime of an uniform thickness of three inches at the least, upon which covering of lime the coffin containing the corpse which shall be buried or deposited in such grave shall be placed.

"4. That not more than one corpse shall be buried or deposited in any grave, and every grave in which any corpse shall be buried or deposited shall be filled up to the level of the ordinary surface of the said burial-ground immediately upon the corpse being buried or deposited therein, and no further burial shall take place in the same grave, nor shall any other corpse be deposited therein.

"5. That no corpse shall be buried or deposited in any grave in the said burial-ground at a less distance than two feet six inches from any other grave, such distance to be computed from that part of the coffin containing such corpse which is nearest to such other grave.

"6. That no corpse shall be buried or deposited in any grave in the said burial-ground in which after the burial or deposit thereof there shall not be at least five feet of earth remaining between the ordinary surface of the said burial-ground and the upper part of the coffin in which such corpse shall be contained.

"7. Provided always that the foregoing directions and regulations which are respectively numbered 3, 4, 5, and 6 shall not apply to burials in stone or brick graves, vaults, or catacombs.

"8. That no corpse shall be deposited in any stone or brick grave, vault, or catacomb, in the said burial-ground, or in any vault or receptacle connected therewith, unless such corpse shall be enclosed in a coffin made of, or lined with, lead, of the weight of at least six pounds to every superficial square foot, and of the thickness throughout of one tenth of an inch, nor unless such coffin or lining be soldered up, or otherwise secured, so as to be perfectly air-tight.

"9. That if in making or digging any grave in the said burial-ground, or in opening any part of the said burial-ground for any purpose whatever, any human bone, or other part of a human body, or any coffin, or portion of a coffin, shall be found, or become visible, the earth that shall have been disturbed by such making, digging, or opening shall be forthwith filled in and covered with quicklime to the depth of at least three inches, in addition to the uniform thickness of lime with which the surface of the said burial-ground is hereinbefore ordered to be covered.

"10. That no grave shall be made or dug, nor shall the ground, for any purpose or upon any pretence, be opened, in any part of the said burial-ground where a corpse has been buried or deposited within ten years now last past."

The burial-grounds named are:—The Crossbones, Redcross-street, Southwark; Tottenham-court-road Chapel ground; churchyard of St. Olave and St. John, Tooley-street, Southwark; St. George-the-Martyr, Southwark; Ray-street, Clerkenwell; St. Paul, Covent-garden; St. Giles-in-the-Fields; New Bunhill-fields; Collier's-rents, Southwark; St. John, Clerkenwell, and the ground in Benjamin-street; St. Mary, Newington; Thomas's burial-ground, Golden-lane, St. Luke's; and Tavistock burial-ground, Drury-lane.

HEALTH OF LONDON DURING THE WEEK.

[From the Registrar-General's Report.]

In the week ending last Saturday the total number of deaths registered was 1,075; the weekly average derived from deaths in the autumnal quarter (which commences with the present month) of five previous years is 1,162; the weekly return, therefore, now exhibits a decrease on the average, after a period of more than three months, during which it has shown a considerable, and in eleven consecutive weeks an enormous, excess above the usual rate of mortality. The decrease is observed in the west, north, and central divisions; the mortality in the east and south, where the deaths from cholera are still the most numerous, is about the average. The deaths from cholera in the last week were 110; in five previous weeks they were 2,026 (the highest number which, exclusive of those from diarrhœa, the epidemic attained), 1,682, 839, 434, 288. In last week the deaths from diarrhœa and dysentery (the mortality of which is more steadily maintained) were 105, almost as numerous as deaths from cholera, and considerably more than usual at this advanced season of the year. The aggregate deaths from these three kindred diseases were, therefore, 215; while the weekly average is only 35. During last week the daily number of deaths from cholera averaged 16; on Wednesday they were only 11. In the districts of St. James (Westminster), Islington, St. Giles (Holborn), Camberwell, and Rotherhithe no deaths from cholera were registered during the week. In Kensington there were 6; in Hackney, 5; in Bethnal-green, 7; in Shoreditch, 12; in Poplar, 5; in St. Saviour, 6; in Bermondsey, 6; in St. George (Southwark), Lambeth, Wandsworth, 7 each; and in Greenwich, 8. In all other districts the mortality from the epidemic did not range higher than four deaths. All other epidemics are at present under the average; smallpox and measles remarkably low; but scarlatina becomes more fatal, the deaths having risen from 39 in the previous week to 56 in the last (the average being 64). Typhus was fatal in 47 cases.

The mean height of the barometer in the week was 29.540 in.; the mean temperature was 46° 7′, which is 4° 7′ less than the average of the same week in seven years; it also shows a decrease on the mean of the previous week of 5°.

MISCELLANEOUS CORRESPONDENCE.

[To the Editor of the Chemical Times.]

Sir,—I hope that the report of the commissioner of patents of the United States on the explosion of steam-boilers (inserted in your journal) will call the attention of parties in this country to the subject. Accidents by explosions of boilers in the marine engines of this country do not seem to be very frequent; but as respects the boilers to stationary engines they are of frequent occurrence; and I think a stringent inquiry ought to be instituted to ascertain their causes. Having had to do with steam-boilers for the last thirty years, I have seen boilers taken out almost in all sorts of conditions;—still none of these exploded. I have taken some interest in reading the evidence and in examining for myself boilers that have blown up or exploded, and, as far as I recollect from memory, these explosions have generally taken place immediately on the starting of the engine, after it had been standing for some time either in the morning the first thing or immediately after meal times. Now, Mr. Editor, do you not think it very probable that the boilers may often run short of water up to stopping time, without any means of supply of water to the boiler in the interval of stopping except by the pump worked by the engine? consequently the boiler or boilers are going on generating steam and reducing the water in the boiler by evaporation. I fear, moreover, that the safety-valve is often tampered with (fastened down, or kept down by additional weight), in order, as the engineman would say, to make a good start. Well, during all this time the water remains in a quiescent state; in other words, it does not boil, in consequence of the pressure of steam on its surface, but goes on getting hotter and hotter, and generating steam of a higher and higher elastic power. This might, perhaps, go on for some time without exploding, were it not that the water is thrown into another condition by the starting of the engine; the valve to which being opened, the steam rushes out of the boiler to fill the cylinder and the condenser of the engine; the instantaneous rush from the boiler to the cylinder and condenser removes the pressure from the surface of the water in the boiler, and consequently causes violent ebullition of the water, whereby the latter is thrown upon the sides, &c., of the overheated boiler, and thus steam is generated at so terrific a rate that I think it would fracture or blow up any boiler, however so strong; no ordinary safety-valve would provide against such a state of things. This is an opinion I have held for years on this subject, and shall be glad to hear the opinion of any of your practical and scientific contributors. In the meantime I remain, Mr. Editor, your very respectful well-wisher and constant reader,

O. B.

P.S. I have seen attached to a large-sized steam-engine a small engine, from one to two horses power, just to pump water into the boiler during the intervals when the large engine is stopped. I think this a very admirable provision, as it is easy to arrange it in a manner to make the water-float in the boiler open the valve to the small engine as the water gets low, and shut it when sufficient water is in, and to make the small or water-supplying engine self-acting when there is any steam;—when there is no steam there is no danger.

TO CORRESPONDENTS.

"A Novice, Carlisle."—The apothecaries' weight is the troy of 12 ounces, but subdivided differently from the so-called "imperial troy weight." The subdivisions of the latter are the ounce, the pennyweight, and the grain: the pound has 12 ounces, the ounce 20 pennyweights, and the pennyweight 24 grains. The apothecaries' troy has equally 12 ounces; but the ounce is subdivided into 8 drachms, of 3 scruples each: the scruple has 60 grains. The sign Lb is used to represent both the apothecaries' troy and the avoirdupois. It is necessary to observe, therefore, that the *former* is meant when the sign is *followed* by Roman numerals, and the *latter* when it is *preceded* by Arabic figures.

"A Manufacturer."—The process mentioned by our correspondent is perfectly safe.

"An Inventor."—You may register at an expense of about £10.

"T. P."—Searle's patent coffee is prepared by evaporating skimmed milk mixed with 1·40th part of sugar, at a low temperature, and, when nearly solid, adding a very concentrated essence of coffee, and continuing the evaporation at a very low temperature (in vacuo, if possible) until the mixture acquires the consistence of a syrup, paste, or candy, which latter may be powdered.

"Mr. Miller, Birmingham."—The article is patented.

"W. S."—Next week.

"Chemicus."—Use the fuming hydrochloric acid.

"Mr. Martin, Hammersmith," is referred to No. 140 of the *Chemical Times*.

"Un Ouvrier, Dublin."—We do not exactly understand what substance our correspondent means. If he will let us know for what purpose the substance in question is used, we will endeavour to give the desired information.

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ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXXIX.

(LECTURE CXII.)

VEGETO-ALKALIS—(*Continued*).

SOLANIA—ATROPIA—HYOSCYAMIA—DATURIA.

Solania, atropia, hyoscyamia, and daturia are found in plants belonging to the family of the Solaneæ. Most of the plants of this tribe are remarkable for their pernicious and often fatal action upon the animal economy; the venomous principle in these plants seems to pervade every part of them. And yet there are some plants belonging to this tribe that are perfectly innocuous; nay, some of them furnish a wholesome food for man and beast. Nevertheless, the mere fact of a plant belonging to the tribe of the Solaneæ ought always to be considered a sufficient reason for the exercise of great circumspection in its use as an article of food.

The roots of the Solaneæ are, with few exceptions, narcotic. The species which are most frequently employed as such are the deadly nightshade (Atropa belladonna), henbane (Hyoscyamus niger and Hyoscyamus albus), the mandrake (Mandragora officinalis), and the Nicotiana rustica and Nicotiana tabacum.

The farinaceous tubers of the Solanum tuberosum (the common potato), and Solanum bulbocastanum, of Mexico, are alimentary, yet they possess a certain acridity. Dr. Nauche professes to have employed poultices of grated potatoes as an excitant. The germs of the potato contain solania; and Brunswick reports a case in which a number of animals that had been fed upon the residue of potatoes which had served for the fabrication of brandy were poisoned and exhibited all the symptoms of poisoning by belladonna and other Solaneæ.

The roots of the Solanum trilobatum, of the Indies, and Solanum sodomeum, of the Cape, are bitter. The roots of Solanum mammosum are used in India as a diuretic; those of Solanum undatum, of Madagascar, are said to be purgative, and yet they are used as a remedy against febrile affections.

The narcotico-acrid property is found strongly marked in the leaves of a great many of the Solaneæ, and more particularly in those of the deadly nightshade, mandrake, henbane, the different species of datura, and a great number of the solanum species, more especially the Solanum toxicarium, of Guyana. The morel, Solanum nigrum, is considered to be deleterious, and M. Dunal has ascertained by numerous experiments that the juice of this plant causes the same dilatation of the pupil as the other Solaneæ; yet this plant is eaten, under the name of "*Brède*," in the south of France, in St. Domingo, and in the Mauritius. The Solanum oleraceum, of the Antilles, and the Solanum sessilifolium, of Brazil, are equally used as articles of food, though it would appear that in the raw state they are decidedly deleterious. The reasonable presumption in these cases is, that the coction in water removes nearly the whole of the poisonous principle; moreover, when these plants are intended to be used for alimentary purposes, care is always taken to gather them at an early period of their growth, when their tissue is still tender, and the juices are but imperfectly elaborated.

The stalk of the Solanum dulcamara is used as a depurative in cutaneous diseases; it partakes of the narcotic properties of the other Solaneæ. The bark of Solanum pseudokina, of Brazil, and that of Bellonia aspera, of the Antilles, are bitter, and used as febrifuges.

The fruits of some of the Solaneæ are eatable; for instance, those of the Physalis alkekengi (winter cherry), which are eaten throughout the north of Europe; those of the Physalis pubescens, of the Indies; the tomato (Solanum lycopersicum); the fruit of Solanum melongena.

But by far the greater number of the fruits of the Solaneæ are poisonous; among them we have to mention more particularly the fruits of the deadly nightshade; of the mandrake; of the different species of datura; of the Cestrum venenatum, of the Cape; of the Solanum acanthifolium, of the Antilles; of the Solanum fuscatum and Solanum carolinicnse, of Western America; of the morel, or Solanum nigrum. The action of these fruits is analogous to that of the other parts of the plant, from which they are respectively derived.

As regards the seeds of the Solaneæ, we know as yet the properties of the following only:—Datura stramonium; Datura metel, of the Indies; Datura sanguinea, of Peru; Hyoscyamus albus; and Hyoscyamus datura, of Arabia.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON THE OXIDATION OF ORGANIC COMPOUNDS.

By Prof. LIEBIG.

In the experiments of Messrs. Schlieper and Guckelberger, on the oxidation of gelatine, caseine, albumen, and fibrine, one of the most remarkable and constant products obtained was an ethereal liquid, valeronitrile, which contains the elements of the valerianate of ammonia, from which the elements of water (and with it all the oxygen of the acid) have separated.

The formation of this substance, containing nitrogen but no oxygen, by a process of oxidation, is certainly a most unexpected fact; and it appeared not uninteresting to submit its production to a more minute examination. As is well known, the above-mentioned animal substances are completely decomposed by caustic alkalis, as well as by acids, with the assistance of heat. From Bopp's investigation it results that in both processes of decomposition two nitrogenous compounds, tyrosine and leucine, are obtained from fibrine, albumen, and caseine; whilst, by the action of acids and alkalis upon gelatine, leucine and glycocoll are produced. Leucine and tyrosine are likewise formed in the putrefaction of albumen, fibrine, and caseine. The contant formation of these substances by three such different modes of decomposition leads to the supposition that albumen, fibrine, and caseine are conjugate compounds, which contain as conjuncts, among others, leucine and tyrosine. In the same manner, glycocoll, or a compound which on the assimilation of the elements of water produces glycocoll, appears to be a conjunct of gelatine.

The greater proportion of the other products which originate by the action of acids and alkalis, as well as by putrescence from the above animal substances, contain no nitrogen; they are organic acids, such as butyric, valerianic, metacetonic, and acetic acids. Butyric acid forms the principal constituent. In Bopp's experiments several pounds of pure anhydrous butyric acid were prepared by the putrefactive decomposition of animal substances.

From all the animal substances submitted to oxidation M. Guckelberger obtained among the non-nitrogenous products, in unequal proportions, butyric, caproic, valerianic, metacetonic, acetic, and formic acids, several aldehydes, for instance, the aldehydes of acetic, butyric, and metacetonic acids, and oil of bitter almonds. The nitrogenous substances consisted of prussic acid and valeronitrile. The residue of the distillation of these animal substances with sulphuric acid and maganese contained neither leucine nor tyrosine.

Regarded as conjugate compounds, albumen, fibrine, and caseine would consist of a group of nitrogenous substances, which, on the addition of the elements of water and of oxygen, are separated into ammonia, leucine, tyrosine (in the case of gelatine, into glycocoll), or into ammonia, valeronitrile, and prussic acid, and into aldehydes or organic acids. The above products originate in a mixture which contains manganese or chromate of potash and free sulphuric acid; and it is highly probable that a separation of the albumen, caseine, fibrine, and gelatine by the action of the acid into ammonia, leucine, tyrosine, glycocoll, and on the other hand into certain non-nitrogenous products, precedes the oxidation, just as would happen if no manganese were present. On both suppositions valeronitrile and prussic acid would be secondary products of decomposition formed by the action of the acids in the presence of oxygen upon one or the other of the solid and non-volatile nitrogenous products, leucine, tyrosine, or glycocoll, resulting from the action of alkali, acids, and putrefaction.

This view has been completely confirmed with respect to valeronitrile, and probably with regard to the prussic acid.

When leucine (Gmelin's oxide of caseine, the aposepedine of Proust) is distilled with dilute sulphuric acid and manganese, valeronitrile and carbonic acid are obtained as volatile products. On employing a more concentrated acid, the distillate is sour, from the presence of valerianic acid; and in this case the residue contains ammonia. Consequently, on the addition of oxygen, the leucine separates into valeronitrile, carbonic acid, and water.

According to the experiments of Bopp, tyrosine furnishes no nitrogenous volatile products on treatment with oxidizing agents.

Glycocoll, treated with dilute sulphuric acid and manganese, is decomposed into prussic acid, carbonic acid, and water. The prussic acid represents the nitrile of formic acid. It is produced from the formiate of ammonia in the same way as the benzonitrile from benzoic acid.

Leucine experiences a totally different kind of decomposition by peroxide of lead, *i.e.*, by the addition of oxygen, in the absence of an acid. In this case mere traces of valeronitrile are obtained; the principal product is the butyric aldehyde* obtained by Guckelberger, an ethereal oily compound, pretty soluble in water, and which is highly remarkable from its property of forming with ammonia a beautiful crystalline compound, which is very sparingly soluble in water. On the first action of the peroxide of lead, valeronitrile passes over, then a quantity of butyric aldehyde, and lastly ammonia, which produces the ammoniacal compound in the recipient, in consequence of which the distilled oily liquids solidify into a crystalline mass. I have previously shown that, by melting leucine (which contains the elements of cyanic acid, amylic ether, and water) with hydrate of potash, valerianic acid, hydrogen, and ammonia are obtained; and, with a more powerful action of the alkali, butyric acid, ammonia, and hydrogen.

With regard to the non-nitrogenous products, which the above animal substances furnish in the different processes of oxidation, it can scarcely be assumed that each of them originates from a separate conjunct, forming a constituent of the albumen, fibrine, or caseine; otherwise we must admit as many conjuncts as there are different products obtained. The one series of these products belongs to a class of acids whose relation to and connection with each other is unmistakeable. The valerianic, caproic, butyric, metacetonic, acetic, and formic acids are members of the series $(C^2H^2)\ O^4$; and all the observations hitherto made leave no doubt that from one of these acids a higher order, or from a more complex radical by the simple addition of oxygen,

* The butyric aldehyde obtained on this occasion furnished on analysis:—

Carbon	67.3	6	66.7
Hydrogen	11.4	6	11.1
Oxygen	..	3	22.2

acids with a more simple radical may be produced. Redtenbacher obtained, in his important investigation on the products of oxidation of oleic acid (an acid which does not belong to the series $2(CH)^n + O^4$), eight acids (of which one proved to be new), which are members of this series, viz., acetic, metacetonic, butyric, valerianic, caproic, œnanthylic, caprylic, and pelargonic acids; and Dr. Schneider furnished a decisive proof that a large number of these acids may be obtained by a process of oxidation from substances containing no oxygen, as the oily hydrocarbons produced in the destructive distillation of fats. From the purified product of the distillation of oleic acid, which contains carbon and hydrogen in the proportion of 6 : 5, Schneider procured, by treatment with nitric acid, œnanthylic, caproic, valerianic, acetic, and metacetonic acids. On employing chromic acid (a mixture of bichromate of potash and sulphuric acid), he obtained, on the other hand, only acetic and metacetonic acids. The acids of the series above the metacetonic acid, if indeed any were produced, as valerianic acid, &c., had been converted into acids containing more oxygen by the chromic acid.

Several views may be entertained respecting the mode in which, by the assimilation of oxygen, acids of a complex radical are converted into compounds of a more simple kind. With the same amount of carbon and hydrogen, butyric acid contains only half as much oxygen as acetic acid, caproic acid half as much as metacetonic acid, butyric acid half as much as caprylic acid; and it is very probable that, by the simple addition of a quantity of oxygen equal to that they contain, caprylic acid may be converted into butyric acid, caproic into metacetonic, and butyric into acetic acid.

This view, simple as it is, has no foundation in fact. If we take into consideration those observations which have been made on the oxidation at low temperatures of these fatty acids which are mostly volatile without change, a different explanation of this transition of one acid into the other must be preferred; and I believe that the law of this metamorphosis has been satisfactorily explained and established by the investigations of Dr. Kolbe on the electrolysis of organic compounds. Kolbe found that when 1 equiv. of oxygen is added to the elements of valerianic acid, considered to be anhydrous, 2 equivs. of carbonic acid separate from it, and a hydrocarbon is obtained, which he calls valyle:—

Anhydrous valerianic acid.....	$C^{10}H^9O^3$
Add to which 1 oxygen.....	O
	$C^{10}H^9O^4$
Deduct 2 atoms of carbonic acid...	C^2 O^4
And there remains valyle.....	C^8H^9

The same chemist has shown, in his interesting memoir, that valyle is converted by the assimilation of oxygen into butyric acid; and has rendered it highly probable that, in the same process of oxidation, oxide of valyle, and perhaps the hydrate of this oxide (compounds which correspond to the ether and alcohol of butyric acid), are formed, and the transition of valyle into butyric acid appears accordingly to take place through the intervention of several intermediate members, among which perhaps should be reckoned the aldehyde of butyric acid, which is isomeric with the butyrate of the oxide of valyle.

Kolbe obtained, as secondary product of decomposition in this process of oxidation, a gaseous hydrocarbon, which has the same per-centage composition as olefiant gas, but twice as high a specific gravity, the formation of which from valyle must be explained by the separation of 1 equiv. of hydrogen in the form of gas, or an oxidation of this hydrogen into water.

Kolbe showed that the transformation of acetic acid into the last member of the series, formic acid, is effected in a perfectly similar manner by electrolysis. 1 equiv. oxygen is added to the elements of anhydrous acetic acid; and it separates into carbonic acid, gaseous methyle, and oxide of methyle, which we know is converted by the further assimilation of oxygen into formic acid.

By Kolbe's process, which is a process of oxidation taking place within a liquid at the ordinary temperature, we have obtained all the intermediate members, which are formed on the absorption of oxygen by an organic acid, and their conversion into the final products, carbonic acid and water.

The general expression of Kolbe's investigation is the following:—When oxygen is added to the elements of an organic acid containing oxygen, the acid splits up into carbonic acid, which contains the oxygen of the acid, and into a hydrocarbon which contains its carbon.

In consequence of the oxidation of the hydrocarbon, an oxide of it is formed, or the hydrate of this oxide, which is converted, by the replacement of a portion of its hydrogen, into an aldehyde—with more oxygen, into an acid, which by the further addition of oxygen experiences another resolution into carbonic acid and a hydrocarbon of more simple composition.

This law of the oxidation of organic substances, the truth of which appears to me to be quite independent of any theoretical speculations which may be formed respecting the constitution of organic atoms or of the organic acids, is alone capable of explaining facts which are opposed to all that we know, viz., that in processes of oxidation products are obtained which contain less oxygen (frequently none at all) than the substance which has been oxidized: it explains the origin of the hydrocarbons, of the organic oxides, of the aldehydes of a lower series, as well as the production of the carbonic acid which makes its appearance in these processes. These organic acids behave in this process of oxidation in an analogous manner to hippuric acid, leucine, and glycocoll, the metamorphosis of which into benzamide, valeronitrile, and prussic acid takes place according to a similar law;* nay, it is quite evident that it is also valid for the separations of higher organic atoms into compounds of a lower degree, quite independently of the causes which produce the separation. Thus, for instance, meconic acid is resolved into carbonic and comenic acid and acetone. The difference between this and the other mode of separation is, that the whole of the oxygen which serves for the production of the eliminated carbonic acid is taken from the substance itself, and not from without. The appearance of carbonic acid in the fermentation of sugar, lactic acid, and malic acid (in its metamorphosis into succinic and acetic acids), as well as that of hydrogen gas in the processes of fermentation, is based on the same law; the hydrogen gas is derived from the substance itself, or from the water which experiences decomposition, that is to say, it is set free owing to the oxygen combined with it being consumed in the formation of carbonic acid. I consider Kolbe's discovery to be a most important acquisition to science, because this law of oxidation is evidently the opposite to that of the formation of higher organic acids (containing little oxygen) from lower ones (containing much oxygen). The production of cholesterine, of oleic and margaric acids, from starch or sugar, or from lactic or butyric acid, in the animal body, cannot be conceived except as an elimination of oxygen in the form of carbonic acid and of hydrogen in the form of water.—*Liebig's Annalen*, June, 1849.

* If we subtract the elements of valeronitrile from those of leucine (the formula corrected according to Laurent, Gerhardt, and Cahours):—

Leucine	$C^{12}NH^{13}O^4$
Valeronitrile	$C^{10}NH^9$
There remain.....	C^2 H^4 O^4

which, on the addition of 4 equivs. oxygen, are converted into water and carbonic acid. If we deduct 1 equiv. prusssic acid from the elements of glycocoll:—

Glycocoll.	$C^4NH^5O^4$
Prussic acid.....	C^2NH
There likewise remains	C^2 H^4O^4

PHYSICAL INVESTIGATIONS IN DYEING.

By M. CHEVREUL,

Member of the National Institute of France, and Director of the celebrated Gobelins Tapestry Works and Dyehouses, Paris.

On the Simultaneous Contrast of Colours.—Whenever the eye simultaneously sees two differently-coloured objects the analogous character of the sensation of the two colours experiences such a diminution that the difference existing between them is rendered proportionately more sensible in the simultaneous impression of the two colours of the retina.

An attentive examination and consideration of this law will enable us to make all the applications of which it is susceptible, whether in assorting coloured objects for the purpose of producing a definite effect, or in judging of the colours of dyed stuffs relatively to their effect upon the eye, without regard to their permanency. Among various examples, I will cite the following:—

Application to the Art of Weaving Coloured Stuffs.—The assortment of coloured thread to imitate the colours of a painting. A painter delineates two coloured stripes in a picture, one being red and the other blue; they are in contact, and consequently the phenomenon of the contrast of two colours in juxtaposition would occur if the painter had not sustained the red contiguous to the blue stripe by blue, and if he had not sustained the blue stripe by placing red or violet near the red stripe.

Suppose a weaver desires to imitate the two stripes of which we have spoken. If he be ignorant of the law of the contrast of colours he will not fail, after choosing wools and silks suitable to the model before him, to make two stripes presenting the phenomenon of contrast, owing to his having selected his wools and silks of only one blue and one red, with a view of imitating the stripes which the painter has only succeeded in producing from two colours (each of which the eye regards as homogeneous through its whole extent) by means of an artifice which no one would detect who was ignorant of the law of contrast. Suppose the painter, instead of painting the two stripes in colours that appeared to the eye to be homogeneous, were to form them with a red and blue that were not blended on their contiguous borders, the colours would certainly in that case contrast. If, now, the weaver be ignorant of the law of this phenomenon, he would not fail, in his attempt to imitate his model, to blend yellow or orange with the red and yellow or green, with the blue in the parts of the stripes that come in contact, and the results would be that the contrast would be more or less exaggerated, from the effect of the picture having been imitated by working with homogeneous colours.

A painter may to a certain extent succeed without a knowledge of the law of simultaneous contrast; for, if he produce an effect with which he is not satisfied depending upon this phenomenon, his palette furnishes him with the means of destroying or increasing it. The weaver has not the same resources at his command; he cannot replace his colours without undoing his work; and to avoid this necessity he ought to be sufficiently well acquainted with the law of contrast to judge of the effect that will be produced by the vicinity of other colours upon the coloured threads he employs in the imitation of a certain part of his pattern, otherwise it will be impossible for him to reproduce a faithful copy of the painting before him.

Now, there are colours, such as yellow and orange, which may be worked in with black without weakening its intensity, whilst there are others, as blue, indigo, and violet, which produce the contrary effect, by giving it somewhat of a yellow, green, or olive tint. It is consequently

neeessary to avoid making blue or violet contrast with black when shadows are to be produced in blue or violet stuffs, and the object required may be obtained by various means, as I am about to indicate.

Application to the Art of Printing Patterns upon Coloured Stuffs or Painted Papers, and Coloured Inks upon Coloured Papers.—In these applications I exclude the consideration of the chemical action that may exist between the substanee of the coloured stuffs or the painted paper and that of the eolouring matter used, confining myself to the optical effect. I have frequently been appealed to as an arbitrator in cases where persons, having given to be printed various coloured stuffs for furniture and ladies' eloaks, have had disputes with the printer on the subject of the patterns, whieh were not of the colour intended. I have often found that these eomplaints depended upon the effect of the contrast of the colour of the designs with that of the ground, and that if the printer were reprehensible it was not for having printed a different colour from the one required, but for not having foreseen the effeet that would result from the eontrast of eolours, one of which was to serve as a ground for another. When black patterns are printed upon red, crimson, or amaranth grounds they appear green, owing to green, the complementary to the ground, blending with the black. For the same reason black, when printed on violet stuffs or on dark green, loses all its force. The method I have adopted in the eases in which I have been appealed to as an arbitrator was, by a simple process, to prove that the designs which did not appear black were actually so, and it consisted in cutting a pieee of white paper in such a manner as to eover the ground and only show the pattern.

Similar difficulties have presented themselves in manufaetories of paperhangings when it was required to produce a design of a slightly yellowish-grey upon a green ground. These designs, although actually grey, appeared, when once printed, to be pink, owing to the complementary eolour of the ground. If they had been on a rose-coloured ground they would have appeared green, for the same reason.

Finally, in wishing to impress letters upon coloured paper, the course to be followed is to choose a ground that is of the colour complementary to that of the ink. Thus, we must use violet-coloured ink for a yellow paper, and yellow ink on a violet-coloured paper; red ink on green paper, and yellow ink on red paper; orange-eoloured ink on blue paper, and blue ink on orange-coloured paper.

Application to the Assortment of Stuffs with the Woods employed in Upholstery.—Amongst the numerous applieations of the law of simultaneous eontrast to the art of the upholsterer and house-decorator there is one to whieh I shall call attention, sinee it is too often disregarded. I allude to the assortment of stuffs with the fancy woods used in upholstery for making easy-chairs, sofas, &c. The principle to be followed in making the most effective assortment is to choose violet or blue stuffs for yellow woods, as orange-wood, the root of the ash, &c.; and green or yellow stuffs for red woods like mahogany. The colour of the stuff must be as different as possible from that of the wood. Many persons prefer, even for mahogany, to have a crimson stuff, owing to its being one of the best colours for standing light. Although this assortment is contrary to prineiple, the bad effect admits of being diminished by plaeing a broad green or black border, either a eord or a printed band, between the crimson and the mahogany. The upholsterer often borders crimson either with gold eord or band, fastened on with gold-headed nails, or with yellow silk eord; and these borders, although not complementary, have, at any rate, the advantage of pleasing many by their brilliancy. There is one assortment, however, which ought never to be made, namely, that of yellowish-red, as scarlet, flame-eoloured, or light red stuffs, with mahogany, sinee their brightness is such that they deprive the wood of that red colour which constitutes its beauty, and makes it resemble very much oak or walnut.

Application to the Distribution of Flowers in a Garden.—Amongst the pleasures presented to us by the culture of flowering plants, there are few that exceed what we experience from the sight of a multitude of flowers varying in their colour, form, and size, and in their arrangement upon the stem that supports them. It is probably owing to the admiration bestowed individually upon each, and to the attachment bestowed upon them in eonsequence of the great care they have required, that care has hitherto not been taken to arrange them in sueh a manner as to produce the best possible effect upon the eye, not only separately, but collectively. Nothing, therefore, is more common than a defect of proportion observed in the manner in whieh flowers of the same colour are made to recur in a garden. At one time the eye sees nothing but blue or white, at another it is dazzled by yellow scattered around in profusion; the evil effect of a predominating colour may be further augmented when the flowers are of approximating, but still different, shades of eolour. For instance, in the spring we meet with the jonquil of a brilliant yellow, side by side with the pale yellow of the nareissus; in the autumn the Indian pink may be seen next to the China rose and the astor, and dahlias of different red grouped together, &c. Approximations like these produee upon the eye of a person aecustomed to judge of the effects of the eontrast of colours sensations that are quite as disagreeable as those experienced by the ear of a musician when struck by diseordant sounds. The principal rule to be observed in the arrangement of flowers is to plaee the blue next to the orange, and the violet next to the yellow, whilst red and pink flowers are never seen to greater advantage than when surrounded by verdure, and by white flowers; the latter may be also advantageously dispersed among groups formed of blue and orange, and of violet and yellow, flowers. For, although a elump of white flowers may produee but little effect when seen apart, it cannot be denied that the same flowers must be eonsidered as indispensable to the adornment of a garden when they are seen suitably distributed amongst groups of flowers whose colours have been assorted according to the law of contrast; it will be observed by those who may be desirous of putting in practiee the precepts we have been indulcating, that there are periods of the hortieultural year when white flowers are not sufficiently multiplied by cultivation to enable us to derive the greatest possible advantage from the flora of our gardens. I will further add that plants whose flowers are to produce a contrast should be of the same size, and that in many cases the colour of the sand or gravel composing the ground of the walks or beds of a garden may be made to conduee to the general effect. In laying down the preeeding rules I do not pretend to assert that an arrangement of eolours different from those mentioned may not please the eye; but I mean to say, that in adhering to them we may always be eertain of producing assemblages of colour conformable to good taste, whilst we should not be equally surc of sueeess in making other arrangements. I must now reply to the objection that might be made, that the green of the leaves, whieh serves, as it were, for a ground for the flowers, destroys the effect of the eontrast of the latter. Sueh, however, is not the case, and to prove this it is only neeessary to fix on a screen of green silk two kinds of flowers, and to look at them at the distance of some ten paces. This admits of a very simple explanation, for, as soon as the eye distinctly and simultaneously sees two colours, the attention is so rivetted that eontiguous objects—especially when on a receding plane, and where they are of a sombre colour, and present themselves in a confused manner to the sight—produce but a very feeble impression.

Applications to the Colours of Dress.—Many persons observe the fact, that a uniform eomposed of cloths of different colours looks well mueh longer, although worn, than one of only a single colour, even when the eloth of the latter is identical with one of those composing the former. The law of eontrast perfeetly explains the reason. If we suppose a uniform to be made of cloth of two eolours, the one complementary of the other, as red and green, orange and blue, yellow and violet, we shall find that the effeet will be most exeellent, from their mutually heightening one another; and supposing further, that they are of equal stability, they will present greater advantages, and appear good, in spite of atmospherie agents, longer than any other binary combination of colours. In a blue and yellow uniform, the blue gives to the yellow an orange tint, whieh greatly heightens its effeet, notwithstanding its tendency as a dark colour to make another colour appear lighter; the yellow imparts in its turn a violet tinge to the blue, whieh eonsiderably improves its appearance; and if the blue had an unpleasant greenish tinge it would be neutralized by the yellow. On the other hand, stains will always be less visible on a dress of different colours than on one eomposed only of a single colour, sinee there exists in general a greater contrast among the various parts of the first-named dress than between the stain and the adjaeent parts; this difference renders the effect of the stain less apparent to the eye. For the same reason a coat, waistcoat, and trousers of the same eolour ean only be worn to advantage together when all are new; for as soon as one of them loses its freshness, from having been worn longer than the others, the difference will increase by eontrast. For instanee, a pair of new blaek trousers, worn with a waistcoat of the same colour, which is old and a little rusty, will make the tinge of the latter appear more conspieuous, at the same time that the black of the trousers will appear more brilliant. White, or even light grey, trousers would produce a eontrary effect. We see from this how advantageous it is to let soldiers have winter trousers of a different colour from that of the clothes which they wear during the rest of the year; and we ean further understand the advantage there is in wearing white trousers with a blue or indeed, generally speaking, with any dark-coloured coat.

ESTIMATION OF CARBONIC ACID IN MINERAL WATERS.

By M. LIMOUZIN-LAMOTHE.

It is not without some difficulty that chemists called upon to analyze the water of a gaseous spring are able to ascertain exaetly the volume of carbonic aeid gas contained in it. This estimation cannot be made with accuracy in the laboratory; indeed, it is necessary to know the volume of gas contained in the water of the spring itself, and not that whieh may be left in the same water after having remained for any time in bottles. Whatever precautions may be used to prevent eseape—however rapidly the vessels may be filled—whatever care we may take in the selection of stoppers, sealing the bottles, &c., we always find, in an analysis made in the laboratory, less gas than in one made at the spring.

The means ordinarily employed are the mercurial bell-glass receiver, or boiling under the bell-glass, proeesses whose actual aceuraey we do not dispute; but if we eonsider the inconvenienees already noticed, and add the further loss of gas during the opening of the bottle and the pouring of the liquid into vessels for the experiments, it must be admitted that the quantity found will be merely a few fractions, and that it will be impossible to ascertain the exaet amount of gas eontained in the spring water.

On the other hand, it is impossible, at least in the majority of eases, to convey to the spring the apparatus indispensable for making on the spot the neeessary experiments. Mereurial troughs, especially, may be regarded as immoveable; besides, they are not in all laboratories, nor within the reach of praetitioners of small localities. This removal would occasion in all cases some expense.

A much more simple process, as easy, more convenient, and within the reach of every one, may, it appears to me, be employed with success.

Before proceeding to estimate the carbonic acid gas, it is necessary to prepare in a large vessel—a boiler for instance—a sufficient quantity of lime-water. The lime must be quite fresh, and the water must be filtered. It may be poured into bottles, which must be perfectly fitted and corked immediately.

After having done this, one or two quarts of the lime-water are poured into a suitable vessel of sufficient capacity, and immediately after one quart of the gaseous water just taken from the well. It is useful to receive the mineral water into a measure capable of containing exactly a quart, and not into a bottle, in order that the water may undergo as little agitation as possible during the mixing of the two liquids. This mixture is continued alternately for several quarts, and the action of the gas on the carbonate of lime obtained is verified. If the quantity of gas contained in the mineral water is considerable, the excess of gas redissolves the carbonate of lime precipitated. In this case a superabundance of lime may be added to effect the absorption of all the free gas contained in the mineral water. If the precipitate is abundant, the alternate addition of lime-water and mineral water is continued until the latter amounts to ten quarts. After the mixing has been well effected, and the combination of the carbonic acid has taken place, the precipitate obtained is allowed to subside, and more lime-water is added to ascertain that all the gas is saturated. If by this addition a further precipitate be formed, more lime-water must be added, until it exists in excess and occasions no further precipitate. This being ascertained, the liquid is left to settle for a short time, and when the precipitate is deposited all the water is decanted, as far as possible, carefully avoiding any waste of the carbonate produced. The precipitate is collected in a filter whose weight has been noted. As soon as the water has perfectly drained off, the product is washed on the filter with pure water (not gaseous), in order to remove the excess of lime-water, which, becoming saturated by the gas contained in the atmospheric air, would interfere with the accurate appreciation of the carbonate of lime obtained by acting, as above, on the spring water.

The precipitate contained in the filter is perfectly dried, after which it is weighed, and the weight is noted, the tare of the filter being deducted.

In this operation the lime dissolved in the water combines with the carbonic acid gas, producing insoluble carbonate of lime. This carbonate precipitates, but not alone: the mineral water, deprived of one of its constituent principles, deposits at the same time the other insoluble carbonates, lime, magnesia, and iron. It retains only the soluble salts, which are removed by decantation and washing.

This first operation being completed, the analysis of the other substances, besides carbonic acid contained in the mineral water, is continued according to the ordinary methods, subtracting from the known weight of the lime precipitated that of the insoluble carbonates. If the mineral water contains, as is most frequently the case, bicarbonate of soda or potassa, these salts also augment the produce of carbonate of lime precipitated. These alkalis abandon their carbonic acid gas and become caustic. It is necessary, therefore, to take account of their action on lime-water, and to deduct, by calculation, the carbonate produced.

These subtractions being made, there will remain only the carbonate of lime produced by the free carbonic acid of the mineral water, and from this precipitate it will be easy, by means of a simple rule of proportion, to ascertain the volume of gas contained in the precipitate obtained, or, in other words, in ten quarts of gaseous water.

Five grammes of carbonate of lime being equivalent to 1 litre and 21 centilitres of carbonic acid gas, the whole may be easily appreciated. Example:—

	Grammes.
Precipitate obtained from 10 litres (quarts) of gaseous water, with sufficient lime-water to completely saturate it	28.75
Deduct the carbonate of lime produced by the normal salts contained in the gaseous water	2.25
Remaining	26.50

5 : 1 lit. 21 : : 26.50 : x = 6 lit. 313.

The 10 litres, therefore, contain 6.313 lit. of free gas, or 0.6313 per litre.

When the object is limited to ascertaining the quantity of carbonic acid contained in the mineral water, the operation is very much simplified: it is then sufficient to boil for a short time ten litres of the same water. The disengagement of the gas effected during the boiling precipitates the insoluble carbonates held in solution. The latter are collected on a filter previously tared, then they are dried and weighed. The product of the filtration is evaporated to dryness, and the quantity of bicarbonate of soda or potassa originally held in solution in the water is appreciated; from these results we determine by calculation the carbonate that this salt produced with the lime-water; this product is added to the carbonates deposited during the ebullition of the water, and subtracted like those of the first precipitate. Example:—

	Grammes.
Precipitate obtained from 10 litres of gaseous water, with sufficient lime-water to completely saturate	24.25
Deposit produced by boiling ..... 2.50 Carbonate produced by the carbonate of soda or potassa. 0.75	3.25
Remainder	21.0

5 : 1.21 : : 21 : x = 5.8.

Ten quarts contained, therefore, 5.8 litres of free gas.—*Journal de Chimie Médicale*, and *Chemist*.

PHOTOGRAPHIC INVESTIGATIONS.

By M. BLANQUART EVRARD.

I have the honour of submitting to the Academy photographic proofs on paper obtained by means of a matrix of albumen. The idea of employing albumen, rendered sensible to the action of light by mixing it with aceto-nitrate of silver, and spread in a fine layer on a plate of glass, belongs to M. Niepce, of St. Victor. It is the most complete confirmation of the principle of the deep impregnation of papers by the photographic substance, a principle which I had laid down previously in a communication to the Academy. "The deep impregnation of the chemical elements in the paste of the paper," I said then, "in such a manner that this paste becomes a medium in which may be accomplished the chemical reactions which finally constitute the photographic image, is a consideration most essential to the success of the operation." (*Comptes Rendus de l'Académie*, vol. xxiv., 117.)

In proposing to substitute for the paste of paper a completely transparent and solid body which might contain the chemical elements, M. Niepce, of St. Victor, opened a new view to photography on paper. Responding to the appeal which he made to experimenters for arriving at practical results, I now submit to the Academy a method which combines all the conditions necessary for the industrial application of photography; for the matrixes on glass, by the preparations obtained on glass which I am about to describe, are unalterable in the light, do not lose any of their qualities after an indefinite number of drawings, are susceptible of being reconstituted, if accidentally lost, provided that we have a single proof of the lost matrix, and finally, at all times, in all temperatures and conditions of light, they give satisfactory results.

As to the quality of the proofs, I propose to send successively to the Academy results to obtain its opinion. I now confine myself to those which appear to me necessary for proving that photography is capable of the production of models, in the very characters of those models: thus, I now present the proof of a miniature portrait produced, of the same size as the original, and in the light and transparent conditions of this sort of painting; a proof after an oil painting in opposite characters, vigorous shades and brilliant lights; a view from nature, with figures (white cows); and a bronze statue of remarkable finish and model; and, lastly, a copy from an engraving of the same dimensions, uniting, notwithstanding this great difficulty, delicacy, model, and vigour.

The following are the preparations:—Collect in a deep vessel a certain number of whites of eggs; remove every thing solid or not transparent; avoid also all dust, which would cause stains. Add fifteen drops of a saturated solution of iodide of potassium. Beat up the eggs into a snow, and allow this snow to rest until it resumes the liquid state. Clean the glass to be used with alcohol, place it on a support, and pour on it a sufficient quantity of albumen. Spread this albumen over the surface of the glass, using for this purpose a piece of glass, in such a manner that its cut side remains in contact with the surface of the glass. Give it several coats. This operation has for its object to put the albumen in perfect contact with the surface of the glass, so that it may be well covered when the excess is run off at one of its corners. After this last operation the glass is placed in a cool position, and allowed to dry.

The albumen being well dried on the glass, it must be subjected to a very high temperature (or very great cold, which has the same effect). Thus made ready, the glass may be submitted to the aceto-nitrate (in the proportion indicated in my communication of the 25th of January, 1847). The contact of the aceto-nitrate with the albumen must be made at one time, for, the albumen contracting on its combination with the aceto-nitrate, there would be as many separations in the layer as repetitions of the immersion. The following is the most easy means:—Pour into a glass vessel, larger than the albumenized glass, aceto-nitrate, to the depth of half a centimetre, and afterwards give the vessel an inclination of 45°. All the liquid being thus collected in the lower part, the edge of the glass, with the albumenized side, on the bottom of the vessel, then, by one and the same movement, let the glass fall into the vessel, and place it on the table in the horizontal position. This done, the glass is immediately removed and plunged into another containing water; agitate briskly for a few seconds, then take it out, and let the water run off, holding it by one of its angles, and striking the other sharply on the table.

Glasses thus prepared are photogenic; they may be employed indifferently in the humid or the dry state, if in case of having to operate at a distance or on a journey. In the same way, the proof may be produced after exposure to the camera obscura, either immediately or on return from a journey.

This operation is practised, as I indicated for paper in my communication of November, 1847, by plunging the glass in a bath saturated with gallic acid; however, to give to the proof all its value, it is advisable to add to the bath a little aceto-nitrate of silver. It will be prudent to take the proof out of the gallic acid before its various parts have acquired the desired tone; for if the action were pushed too far we could not weaken the too deep tones which they would present, whilst, if its shades were too weak, we might, without inconvenience, submit it again to the action of gallic acid, even should the matrix have served for producing a great number of proofs.

After this operation the glass should be washed in a large quantity of water, and afterwards passed into a solution of bromide of potassium (30 grammes in 100 grammes of water), then

washed again in a large quantity of water, and finally dried by keeping it extended horizontally in the camera obscura, if the layer of albumen has formed some streaks, and is raised in places, through the various immersions which it has undergone.

Thus treated, the albumen acquires on the glass extreme hardness and solidity, so that when an incomplete proof has to be destroyed, in order that the glass may be used again, it is necessary to have recourse to a very energetic chemical agent, such as cyanide of potassium, to remove it completely.

The positive proofs were obtained in the same manner as the clichés on paper.—*Comptes Rendus*, No. 8, August 20, 1849.

ON A COPPER AMALGAM.

By Dr. MAX PETTENKOFER.

In Paris some dentists employ an amalgam of copper with great advantage for filling the cavities of carious teeth. This amalgam is sold in little cakes, which weigh between 4 and 5 grms., and cost two francs each. The surface is of a greyish colour; the hardness is very considerable, and the adhesion of the minutest parts so strong that the amalgam requires a powerful stroke of the hammer to be broken. It has a finely granular crystalline texture. A sample examined by me consisted of 30 parts of copper and 70 parts of mercury. When this amalgam is heated nearly to the boiling-point of mercury, it has the peculiarity of swelling somewhat, and a few drops of mercury appear on the surface. When it is now triturated for some length of time in a mortar, it becomes after cooling so soft that it may be kneaded between the fingers like moist clay. In this state it can be pressed into the smallest cavities. After a few hours it becomes so hard that with a sharp-edged piece of this copper amalgam one can engrave upon tin and cut bone. When the previously-hardened amalgam is again warmed, and submitted to the above-mentioned manipulations, it again becomes plastic, and after a few hours again solidifies. In the soft state, a very liquid amalgam of copper and mercury can be expressed by a powerful pressure between the fingers. The specific gravity of the plastic copper amalgam in the soft and hard state appears to differ very little.

This metallic compound is a very interesting example of the effects of crystallization and amorphism on the properties of bodies. In the soft state it shows not a trace of crystallization. It can be spread on an anvil with a knife or hammer, like plaster; but when hardened it is very brittle; thin layers break like glass, and the fracture is granular crystalline. Among the metals this copper amalgam is the first known example of the two states of a body at the same temperature; and it is quite as instructive as the elastic amorphous sulphur and the brittle stick-sulphur is amongst the metalloids. That the specific gravity of the amalgam does not vary perceptibly in the transition from the amorphous into the crystalline state is for the purposes of the dentist a most valuable property, as it must be of importance that the mass after cooling should occupy exactly the same space as in the soft state. I have pressed the plastic amalgam into glass tubes, and let it harden in them; after cooling it formed a perfectly air-tight stopper.

I have prepared amalgams which contained between 25 and 33 per cent. of copper, and all solidified to a crystalline mass after being heated; those which contained most copper solidified more quickly and became much harder than those containing less. Alloys of 24 parts copper with 75 parts mercury required three days to pass completely into the crystalline state. There is no atomic proportion between the copper and mercury in these crystalline compounds, any more than between the constituents of other metallic alloys. Were we to suppose a combination of 1 equiv. copper with 1 equiv. mercury, this would require, in 100 parts, 23.8 copper and 76.2 mercury. Perfectly analogous compounds occur in the native crystalline silver amalgams; the analyses have shown their amount of silver to vary between 25 and 86 per cent. When, therefore, two metals can crystallize together, this merely proves that they are isomorphous. This is the case with copper, silver, gold, and mercury.

This copper amalgam is likewise interesting as an example of the transference of the state of aggregation from one body to another; the liquid mercury passes with the solid copper into the same firm crystalline state, which alone it is only capable of assuming at a very low temperature, as many salts pass from the solid into the liquid state by contact with water.

The preparation of the copper amalgam does not succeed according to every method. I had to try several plans before I obtained it equal to the Paris sample. I found the following to be the best:—A weighed quantity of mercury is dissolved in boiling sulphuric acid, and the crystalline paste of the sulphate of the per and protoxide of mercury, triturated with finely-divided metallic copper, in a mortar with water, at 140° to 158° F., for some length of time. There must be so much metallic copper present that in the first place the whole of the mercury is reduced; and secondly, that as much copper can amalgamate with the reduced mercury as the alloy requires. The copper obtained by reducing oxide in hydrogen is best suited for the purpose; but that precipitated by iron from sulphate of copper is likewise applicable. The well-washed plastic amalgam is placed in a leather bag, and as much mercury as possible pressed out of it; it is then formed into little cakes; after several hours, varying with the amount of mercury, it hardens to a mass, the fracture of which resembles in appearance the brittle alloy of gold and lead. The first hardening requires much more time than the second; when, for instance, it is made soft for use, it sets much quicker.

The useful applications of this amalgam are evident from its physical and chemical properties; for instance, for stopping machines and chemical apparatus where cork, glass, caoutchouc, cement, &c., cannot well be used; and there may likewise be cases where it will prove of service to the artist and the surgeon.

[In an editorial note it is stated that this copper amalgam may be very easily procured by moistening finely-divided copper, precipitated from a solution of the sulphate of iron, with protonitrate of mercury, in a porcelain mortar, pouring boiling water over it with the addition of metallic mercury, and triturating it uninterruptedly for some time. At first the mas is brittle, but soon becomes soft, and acquires, when the right quantity of mercury has been incorporated, the desired salve-like consistence.]—*Ann. der Chem. und Pharm.*, June, 1849.

ON A MEANS OF RENDERING IVORY SOFT AND SEMI-TRANSPARENT.

By M. GEISLER.

For a long time articles have been made and sold in Paris made of semi-transparent ivory, and which, when steeped in warm water or warm milk, soften, and become supple like thick leather. M. Geisler has made some experiments on the modes of preparing this ivory, which have been attended with successful results.

Ivory articles are dipped in a solution of pure phosphoric acid, of sp. gr. 1.130; and allowed to remain in this solution until they assume a transparent appearance; they are then removed from the phophoric acid solution, well washed with water, and dried in a piece of soft linen. The articles so treated are thus made so flexible that they appear like leather; exposed to the air they become hard, but regain their suppleness when dipped into hot water. A less concentrated solution of phosphoric acid produces no effect. As to the duration of the immersion of the ivory in the solution of phosphoric acid, this cannot well be determined previous to a trial, because there are some sorts of ivory which require a longer time for immersion than other kinds of the same thickness. Other acids, such as sulphuric, hydrochloric, acetic, &c., fail to produce this effect.

This action appears to be due to a solution of a part of the lime contained in the ivory, thus forming a compound less rich in lime than ivory, which, it is well known, consists of three fourths of phosphate of lime, a small quantity of carbonate, and one fourth of a gelatinous substance. A microscopical examination made by M. Oschatz of softened and of natural ivory shows that the ivory submitted to the above process has undergone no alteration in structure.

REPORT OF THE COMMISSIONER OF PATENTS OF THE UNITED STATES ON EXPLOSIONS OF STEAM-BOILERS, DECEMBER 30, 1848.

[*Concluded from page* 241.]

It is objected to this provision that the district judge is not likely, from the character of his pursuits and associations, to be able to form a very correct estimate of the qualifications of applicants for the office. In some cases his residence is remote from the port where the duties of the inspectors are to be performed, which renders it improbable that he could have any personal knowledge of the character of applicants, or be able to exercise over them any supervision. It is, therefore, proposed to place the appointing power in the hands of a resident, or residents, of the port where the inspections are to be made, and with individuals the character of whose pursuits is calculated to render them competent judges of the qualifications of the applicants for the place of inspector.

Again; this section makes no provision for a separation of the duties of inspecting hulls and inspecting boilers and machinery; but renders any inspectors competent to perform both. The qualifications necessary to perform one of these inspections are quite different from those requisite to perform the other. The inspector of hulls should be a man well acquainted with boat-building, whereas the inspector of boilers and machinery should be a sound practical engineer. The union of both these offices in the person of each inspector renders it almost certain that one of the duties will be ill performed, and gives rise to a rivalry and competition in the highest degree prejudicial to the character of the inspection; for there is but one voice as to the existence of the fact that steam-boat owners and captains will always employ in preference the inspector who is least faithful in the performance of his duty. By dividing the offices, and thus taking away competition, the inspector would be more independent, and more likely to make his inspection thorough. This end would be still farther secured by requiring that all boats in a certain trade should be inpected at a certain port, thus limiting each boat to a single inspector.

A recommendation which contemplates the examination of inspectors by a board consisting of the best practical engineers has been made with great unanimity by all who have proposed modifications of the law. It is also proposed that the same board should decide on the qualifications of engineers, who should not be allowed to hold the office without a certificate from the board of examiners; nor should boatowners or captains be permitted to employ engineers without such certificate.

The elevation of the character and standing of the engineer becomes, in the views of the subject taken in the former part of the report, a matter of primary importance to the safety of the public. It is a fixed principle of human nature that men become worthy of confidence and respect in proportion as they feel themselves to be respected. Services which are deemed worthy of the special notice of the law, which are well paid, and to perform which a man must go through a course of preparatory training, and submit to a rigid and impartial examination,

assume, in his eyes, an importance which they cannot have when he receives his appointment without inquiry as to his qualifications, and is left to perform its duties as he may. In the former case, the right performance of duty becomes a point of professional pride; in the latter, it sinks to a mere question of pay. The unanimity with which the recommendation above alluded to has been made, of a board of examiners before whom all candidates for inspectorship, or the office of engineer, should be required to pass before obtaining the office sought, entitles it to respectful consideration. In relation to another department, where the health and life of individuals are placed under the professional care of medical men, the Government has acted upon the plan here recommended. The evidence of having received a medical education, and the diploma of the most eminent medical school, are not considered a sufficient guaranty. The candidate for a medical appointment, in either arm of our military service, must pass a searching examination, by an able board of examiners, as to his knowledge of the theoretical and practical parts of his profession; yet the number of lives dependent upon the skill and care of any one of these officers is not for a moment to be compared with those that hang upon the doubtful competency of an inspector of steam-boilers or a steam-boat engineer. The ignorance of the former may send men to their graves *singulatim* and by retail; but one act of carelessness in the latter may cause the instant destruction of hundreds. If the magnitude of the interest at stake is a sufficient reason for the examination in the one case, it is, *à fortiori*, a reason in the other. Faithfully administered, there can be little doubt that such a system would tend to give new dignity to the employment, by establishing a higher standard of qualification.

The fourth section of the law prescribes the duties of the inspector of hulls and regulates his fees. The inspection of hulls by a Government officer is thought unnecessary, inasmuch as the insurance-offices, which have a deep stake in the security of the vessel, have competent inspectors appointed by themselves, whose examination, it appears, is much more rigid than that of the Government inspectors; and it is said to be no uncommon case for a boat to be condemned by the insurance-office inspector which has just received the certificate of the United States officer. It is urged moreover, with some force, that vessels which navigate the ocean, the soundness of whose hulls is a matter of much greater consequence to the safety of the travelling world than that of the hulls of steamboats, are not burdened with this tax, but left to the exclusive care of the insurance inspectors. It is proposed, as an additional amendment to this section, that the inspectors should be paid by the Government.

By the fifth section of the law the inspectors are required to make a certificate as to the soundness of the boilers, and to furnish the master or owner of the boat with a duplicate of the same. If the inspection as at present conducted be, as it is represented, a useless tax upon boatowners, and of no value as a guaranty of the safe condition of the boilers, the certificate can only serve to beget a false, perhaps a fatal, confidence in the minds of the passengers. Such is the opinion expressed by the Cincinnati Association of Engineers.* Before the certificate can be of any value, the course to be pursued in the inspection must be plainly laid down, and some exact standard of thickness, strength, &c., be adopted, below which no boilers should be suffered to fall without a denial of the certificate.

The intervals at which inspections of hulls and boilers are to be respectively performed are regulated by the sixth section of the law. The fact, well ascertained, that the strength of boilers may be so impaired by the misusage of a single trip as to be utterly unsafe, would seem to be a sufficient objection to such a limitation. And yet to subject the owners to frequent inspections at a heavy cost, and which may possibly be in most cases unnecessary, appears to be a measure unwarrantably oppressive, and which would operate most severely upon those who were most worthy of public confidence. Some have gone so far as to recommend the monthly application of the hydrostatic test. To secure the benefit of frequent inspections, while their oppressiveness to owners should be avoided, it has been suggested that the inspectors should receive from the boat their fees for the semi-annual examination, and, in addition, a small salary from the Government, in consideration of which it shall be their duty to visit and inspect, without unnecessary delay, each boat that arrives at the port.

The seventh section requires the safety-valve to be opened, when the vessel stops for any purpose whatever, under a penalty of two hundred dollars. Such a provision must have arisen from a misapprehension of the consequences that may arise from the adoption of a fixed rule with regard to the opening of the safety-valve. If the views advanced in the former part of this report as to the causes of explosions be correct, the opening of the valve at a stopping-place might, under some circumstances, be the cause of the very accident it was intended to prevent. If the water were low, and the top of the flues overheated, the opening of the valve, causing a violent ebullition or "frothing," would throw the water into contact with the overheated metal, thus suddenly generating a quantity of highly-elastic steam, to which the valve could not afford a sufficiently rapid exit, and an explosion would be the necessary consequence.* Measures tending to elevate the character of the engineer, and render him more careful and trustworthy, would do away with the necessity for any such interference with the minor regulation of the engine.

The penalties provided in the twelfth section of the law are regarded as too harsh, and it is found that on that account they cannot be enforced. Juries cannot be induced to subject a man to the penalties of manslaughter for an act of negligence to which they find it impossible to attach the degree of guilt which so severe a sentence would seem to imply.

The thirteenth section makes the fact of the explosion *primâ facie* evidence of negligence in all suits or actions against proprietors of steamboats for injuries arising to persons or property from the bursting of the boiler, &c. This provision, it is urged, raises an adverse presumption upon a fact which it is impossible to deny, and throws upon the defendant the necessity of proving a negative, a task always difficult, and rendered peculiarly so by the circumstances of terror and excitement which always attend these events. The severity of this feature of the law is said to have driven many worthy and enterprising steam-boat proprietors from the business, and left it in hands less responsible.

The law of 1843 has exclusive reference to the steering apparatus of "vessels propelled by steam," and, therefore, has no bearing upon the subject of this report.

Such, then, are some of the objections to the existing law which have been advanced by men who have had the best opportunities of witnessing its practical working. Though it can scarcely be denied that they are, in the main, well founded, yet the undersigned is not prepared to recommend the remedies which are suggested. He is convinced, by as thorough an examination of this subject as his time and the means of information in his possession would permit, that, by descending to the details of management in matters of which it cannot be the best judge, the law subjects itself to the charge of oppression, or lays itself open to contempt. If constructors and engineers could be made competent and careful, there would be no necessity for minute directions, and, where they are not so, no legislation can protect the public against the consequences of their misconduct. For it is not to be supposed that a man who would neglect his duty, at the risk of his life, could be induced to perform it by any motives the law could bring to bear upon him.

It is the deliberate opinion of the undersigned that the best remedy for all the evils complained of would be to make a strong appeal to the interests of boat masters and proprietors, by giving a remedy, where explosions result in injury to persons or property, to the individuals wounded, or to the nearest relative or friend of the killed, in the shape of heavy damages recoverable by action at law. And the undersigned would recommend that, in addition to the personal responsibility of the owners, the boat itself should be held by way of lien to respond the damages which may be recovered by the plaintiff; and that, in case the owner is an incorporated company, the members of the company should be held severally as well as jointly liable in their individual capacities. Such a course would bring the most powerful motive to bear to force the proprietors to employ in the construction of boats the best materials and the most skilful and faithful workmen, and to entrust their management to those engineers alone who can bring the most satisfactory evidence of their competency, carefulness, and good character. Properly constructed, the steam-engine is believed to be as free from defects as most human contrivances, and, under careful and intelligent management, as free from danger as the nature of the powerful agent it is intended to control can allow us reasonably to expect.

In expressing these views the undersigned would not be understood as intending to undervalue or discourage the exercise of ingenuity in the multiplication of the means of security, or those investigations of science which tend to develop the natural causes upon which these lamentable occurrences may depend. On the contrary, he is convinced that the Government cannot more legitimately exercise an enlightened care over the safety of the people than by fostering such ingenuity, and promoting such investigations by providing the means for their prosecution.

The peculiar circumstances of western steam navigation seem to make it a subject worthy of special attention. The fact that disasters seem in a great measure to have ceased in all parts of the country except on the Mississippi and its tributaries renders it probable that there are causes in operation on those waters which do not exist elsewhere, and which deserve investigation. One of those causes may be found in the quantity and peculiar nature of the deposits from the turbid water of those streams. From a report made to the American Association for the Advancement of Science, in September, 1848, it appears that of the whole mass of water passing down the Mississippi, when examined near Natchez, not less than one part in every 528 is solid matter, capable of being deposited by simple repose. How much more would have been deposited had the water experimented on been evaporated to dryness, or, in other words, how much solid matter was in a state of chemical solution, has not yet been determined. That the quantity thus held in solution is very considerable is rendered probable from the known fact that the waters of the Ohio at least give incrustations to evaporating vessels, even when no turbidness or mechanically suspended matter exists in it. It is also known to possess the quality of "hardness," as proved when tested by the usual reagents.

The exact nature of these sediments has not yet been ascertained, but seems eminently worthy of a careful determination. Their bearing upon the question of efficiency of the safety apparatus is frequently alluded to in the report of the board of examiners of 1844, so often referred to; but the investigation, not being contemplated by their appointment, was not gone into. The utility of such an investigation will be apparent from the fact before alluded to, that in the case of sea-going steamers it has led to the discovery of the nature of some of these

* Doc. H. R., No. 20, 29th Cong., 1st session.

* Doc. H. P., 20, 29th Congress, 1st session.

incrustations and the application of a solvent.—The same minute and searching inquiries which have been instituted with regard to the strength of materials for boilers, the causes of explosions, and their remedies, and the numerous incidental questions hitherto examined under public authority, if applied to the peculiar circumstances of western navigation, would undoubtedly tend to develop the causes, and suggest remedies for the evils which still exist in connection with that important branch of our internal trade. Many points of the subject would suggest themselves to the scientific minds to which it should be referred—minds competent to detect by observation and develop by experiment the difficulties in which it is involved.

I have thus, as far as the means of information in my possession permitted, complied with the requisition of the Senate. In doing so free use has been made of the latest and best authorities on the subject of boiler explosions, and it is believed that full credit is given wherever such sources have been resorted to. The labours of the Franklin Institute Committee have been considered as the most valuable additions to the amount of our knowledge on the subject, and they have, therefore, been largely quoted. It is a subject of regret that so little that is new in relation to the causes and the means of prevention of explosions could be submitted for your consideration. The accounts given in the returns go so little into detail, and are marked by so many important omissions, that any satisfactory generalizations from them were rendered almost impossible. But the undersigned is of opinion that, though the present report may throw no new light on the subject, yet the service of presenting in one condensed general view a *resumé* of the present state of knowledge in relation to this subject in a form intelligible to the general reader may be one of some value in its bearing upon intelligent legislation, and as affording a useful source of information to the practical men, perhaps deficient in scientific knowledge, into whose hands this report may possibly fall.

The main points of this inquiry seem to have been exhausted by the very able report of the committee of the Franklin Institute. Their investigations may be considered as having settled most of the questions to which their attention was directed. There still remain, however, some points not fully determined by that committee, and which have already been alluded to in this report, but which may well be recapitulated here. They are:—1st. As to the extent to which a local relief of pressure would operate to produce a difference of level in the water in a boiler, and whether an explosion could result from such difference. 2d. A more full investigation of the repulsion between water and metals heated to a certain temperature. 3d. The whole subject of incrustations is yet comparatively open as a field for investigation.

On these points the undersigned takes the liberty of suggesting the institution of an investigation to be made at the expense of the Government, and conducted, as were the valuable labours of the Franklin Committee, under the auspices of some recognised scientific association. On the subject of deposits, these experiments should extend to the sediments of all the principal rivers navigated by steam in our country. Aside from the relation to the subject now under consideration, the geological results of such an investigation could not fail to be of great interest and value.

I have the honour to be, very respectfully, your obedient servant, EDMUND BURKE.
Commissioner of Patents.

To the Hon. Geo. M. Dallas,
Vice-President of the United States,
and President of the Senate.

STEAM-BOILER EXPLOSIONS IN FRANCE.

M. Lorieux, engineer in chief of the mining department, and secretary of the central commission of steam-engines, has lately presented to that commission a report of considerable interest. In it he gives a statistical account of the steam-boiler explosions which have occurred during the last twenty-two years. It would appear from this report that from 1827 up to 1848, inclusively, only 40 accidents have occurred in stationary engine-boilers, the number of which has increased from 500 in 1817 to 10,000 at the present day. From 1827 to 1830 not one accident occurred.

In 1830, 3 accidents in 1,132 boilers then in use.
" 1832, 2 " 1,354 "
" 1833, 1 " 1,726 "
" 1834, 1 " 1,862 "
" 1835, 1 " 2,385 "

From 1835 to 1838 no accident is known to have occurred.

In 1838, 1 accident for 2,693 boilers then in use.
" 1839, 1 " 5,100 "
" 1840, 1 " 5,360 "
" 1841, 3 " 5,605 "

In 1842-43 no accident.

In 1844, 2 accidents for 6,937 boilers then in use.
" 1845, 6 " 7,594 "
" 1846, 6 " 8,023 "
" 1846, 10 " 8,980 "
" 1848, 2 " .. "

Up to 1848 there had occurred only two explosions of locomotive engine-boilers; one on the St. Etienne Railway in 1845, the other at the Corbeil station, on the Northern line, in 1846.

Annexed is a table of the accidents which have occurred in the boilers of steam-vessels since 1827, a space of twenty-two years:—

In 1827, 1 accident for 42 vessels.
" 1827 to 1833, no accident.
" 1833, 1 accident for 95 vessels.
" 1833 to 1837, no accident.
" 1837, 2 accidents for 134 vessels.
" 1838, none.
" 1839, 2 accidents for 237 vessels.
" 1840, none.
" 1841, 2 accidents for 243 vessels.
" 1842, 1 " 249 "
" 1843, none.
" 1844, 2 " 264 "
" 1845, 1 " 293 "
" 1846, 1 " 350 "
" 1847, 2 " 325 "
" 1848, 3 " 400 "

18 accidents in 22 years.

In the conclusion of the report M. Loricux has pointed out the causes of these accidents, which almost always result either from the use of iron of bad quality, the pressure of steam being greater than the strength of the boiler, the want of proper care or attention, or the employment of boilers not approved of by the Administration.

In France no steam-boiler nor locomotive-engine can be legally used without having been first submitted to the examination and test of one of the Government engineers appointed for that purpose,—a plan which might be beneficially adopted in this country.

ANALYSIS OF IMPURE AIR.—Lassaigne has examined the nature of the air of those places where men were living in a crowded state, and where there was hardly any communication with the external atmosphere. The results obtained were almost invariably the same. Of 100 volumes of the air there were 79.35 to 80.10 azote, 19.35 to 20.10 oxygen, 0.32 to 0.62 carbonic acid. The air near the ceiling contained as much carbonic acid as that near the floor. Gräger, of Mulhausen, ascertained the proportion of ammonia contained in the atmospheric air, by allowing the latter to pass through hydrochloric acid, and binding it thus to platina. He found that 1.06 cubic metre at 0° C. contained 0.0008466 gramme of carbonate of ammonia, or that 100,000 parts of atmospheric air contained 0.6148, that is three fifths millionths of carbonate of ammonia. An inquiry on rainy days and in dry weather was attended with the same results.

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THE CHEMICAL TIMES.

SATURDAY, OCTOBER 27, 1849.

THE METROPOLITAN WATER QUESTION.

THE late epidemic has not been without its good results. Two hygienic violations have been forced by it into such salient prominence as to challenge the observation and comment of all; and we venture to say that such prominence has begotten an agitation that will never rest until the hygienic violations have ceased. It would be hard to say whether the abolition of intramural interment, or the abolition of the present ill-regulated and defective water supply, would be the greater, the better achievement. In some measure each reacts upon the other, so that it is difficult to unravel the nexus which combines the two; for, in consequence of the disgusting plan so prevalent in London of sinking the parish pump on the verge of—frequently *in*—the parish churchyard, our stomachs are made to imbibe corpse-sodden water, whilst our lungs are slowly, but surely, poisoned by corpse-impregnated air.

It has only lately been discovered that the plan of chartering a company or companies for the purpose of supplying water by means of a commercial monopoly is a totally indefensible plan — indefensible as regards hygiene — indefensible as regards morality. Without the means of domestic and personal cleanliness, it is as vain to infuse feelings of self-respect, the foundation of all morality, as it is to implant the seeds of health. To both the soil is alike barren, unproductive, cold. In fact, then, as it is clearly indefensible for hygiene or morality to be constituted an element of any commercial speculation whatever. Fortunately there is no plea whatever for a tenderness of interference with vested rights so far as the water companies are concerned. They have all been most remunerative, and have been proved by their own showing to have long pressed with much unnecessary severity on the poor. The New River Water Company alone enjoys an income of about £130,000, whilst its annual expenditure scarcely exceeds £40,000, and yet they dole out intermittently their supplies as though they were losers by a bad speculation, instead of adventurers who have appropriated from their revenue at least one and a quarter of million of pounds sterling to a capitalized fund. The other water companies, although not so rich as the New River Company, have yet mulcted the public of quite enough to warrant an act of Parliament for consolidating them into one centralized commission of supply for a very moderate, but equitable, consideration.

STATEMENT IN CONTINUATION OF THE ONE PUBLISHED IN THE CHEMICAL TIMES OF OCT. 20, 1849, SHOWING THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE AIR FROM OCT. 14 TO OCT. 20 INCLUSIVE, AS INDICATED BY THE EVAPORATION OF WATER FROM TWO COPPER VESSELS OR SCALES, ONE INSULATED AND THE OTHER NOT. ALSO THE READING OF THE BAROMETER, THERMOMETER, DIRECTION OF WIND, AND GENERAL STATE OF THE WEATHER.

Oct., 1849.	Barometer.		Therm.		Scales.				Wind.		General state of weather.
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Insulated	Non-Insulated	Morning.	Evening.	
14	30.00	30.05	45	42	..	20 N.	..	20	E.	E.	Fine all day.
15	30.03	30.05	44	42	..	..	..	..	E.	NE.	Ditto.
16	30.05	29.95	44	49	20 N.	25 N.	..	45	SE.	SE.	Ditto - heavy rain at night.
17	29.90	30.00	57	57	15 I.	5 I.	20	..	SW.	SW.	Heavy rain at 3 A.M.; very fine morning; rather overcast afternoon.
18	30.15	30.18	60	59	10 I.	10 N.	10	10	SW.	S.	Fine all day.
19	30.07	29.87	58	61	10 I.	10 N.	10	10	SE.	SE.	Heavy dew at night; fine all day.
20	29.85	29.90	61	59	10 I.	..	10	..	SW.	SW.	Fine all day.

The scales, it will be seen, indicate a decided change for the better in the electrical condition of the air, and that condition appears to improve. On reference to the tables of April and May it will be seen that the scales indicated the approach of some such complaint as the cholera seven weeks before its arrival; and the decrease in the mortality from cholera has preceded a corresponding change in the scales, or electrical condition in the air, by about three weeks. When will the scientific world deign to notice this beautifully simple instrument?

Westminster-road, Oct. 23, 1849. FRANKLIN COXWORTHY, Author of "Electrical Condition," &c.

FRANKLIN COXWORTHY'S DISCOVERIES IN NATURAL PHILOSOPHY.

[*Continued from page* 237.]

When treating of the principles of heat, we observed that, although in the doctrine of the diffusion of gases the scientific world might be assumed to be generally agreed, on that of heat the very highest authorities were completely at issue. If, then, such a difference of opinion amongst the sages of the day relieved us of the necessity for any apology to our readers for the introduction of more intelligible views, our embarrassment on the present occasion must be still more ideal; since on the important question to which we are now about to advert no opinion at all has ever been advanced.

On the "diffusion of gases" our discoverer has the disadvantage of being at issue with the unanimous view of *all* the learned of every country. Fearful odds; although truth has ere now prevailed against greater numbers. On the doctrine of "heat" our still unaided champion found divided opponents, agreeing only in being antagonistic to him. But in what consists the principle of the "attraction of cohesion" of matter no opinion has been expressed, until Franklin Coxworthy ventured upon the exposition of his own. Ask information on the subject of one of our *savans* and the probability is that he will thus illustratively express it:—If two pieces of wood, or other soft material, be subjected to a sufficient pressure, they will be held together by 'attraction of cohesion.'" This, *ad vulgam*, means that they will stick together. But what constitutes the adhesive or sticking principle we shall not be informed, unless we consult our preferred authority. And this remark applies equally to the "attraction of gravitation," notwithstanding the primary discovery of the effect, and the mathematical definition of the law, given to a grateful world by the illustrious Newton. Wide was his field of research, wonderful the results of his labours; yet his discoveries stopped short of developing the cause or moving principle of gravitation.

Let us continue our process of examination in juxtaposition, however ultra-posited the propositions:—

Old Doctrine.	*New Doctrine.*
That matter is held together by "attraction of cohesion."	That electricity is the bond of union in matter; is absorbed during its formation; and is evolved during disintegration or decrystallization.
That matter is drawn towards the centre of gravitation by "attraction of gravitation."	That gravitation is referable to electrical condition; and that matter, therefore, by compression or contraction, actually *increases in weight*, with increase of specific gravity.

Reflecting on the phenomena connected with meteorology, and particularly on the formation and decrystallization of snow—on crystallization—and on electrical condition with reference to heat, the first of these two propositions naturally assumed the position assigned to it.

The paper on which we write this article affords us an illustration. If either of our readers has access to undisturbed hotpressed and glazed paper, and will try a very easy experiment, in the dark, with a ream of it, he will find that, on rapidly separating the sheets from each other from corner to centre, a spark or flash of electric fluid will instantly follow the act of separation. At the same time he will become aware, from the resistance offered by the sheets of paper to such a severance, that they were held together by an adhesive force. And thus have demonstrated the fact of the cohesive power of electricity. The sheets in close contact, the presence of electricity was perceptible; contact broken—continuity destroyed—and the fluid explodes.

Perhaps the most beautiful illustration of the principle that electricity is the bond of matter is found in the use to be made of perfectly dry lumps of loaf sugar, and of a glass bottle equally exempt from moisture and unquestionably clean. Loaf sugar is highly crystallized, and its particles are, consequently, held together by a large proportionate amount of electricity. Half fill the bottle with such sugar, in lumps of the common size for domestic use; and, shaking it well in a dark room, the whole interior of the bottle will become luminous with the electrical sparks evolved during the disintegration—the breaking into smaller pieces—of the sugar. Indeed, the same effect may be produced, of course in a less satisfactory manner, by turning such dry sugar, with a rapid, continuous motion (as distinguished from a jerk), from one vessel into another.

On the hypothesis, then, that electricity is the bond of union in matter, and that it is identified with cold (as we have previously averred), we can have no difficulty in explaining a vast many phenomena connected with heat that have hitherto puzzled the philosopher and bewildered the student. We have an apt and readily understood illustration in the passage of ice, under the influence of heat, to the aëriform state.

All matter has a tendency to return to its naturally electrical state. The gases, therefore, generated by combustion, being in a highly negative or heated state, will readily abstract from ice, if it be subjected to their influence, its electricity of crystallization; and, until the whole of it be decrystallized, the liquefying contents of the vessel used in the experiment will not rise in temperature. When, however, all the electricity of crystallization has been abstracted, the water, by a further loss of electricity, will begin to rise in temperature and to increase in volume. Freed of its electricity, it has room for heat, it remains cold no longer; and this heat or negative state, if applied to it, may go on increasingly until what was ice will become steam. And then the steam rushing upward acquires, in turn, a new dose of electricity (or cold) from the air, and is converted into water again—if the dose be strong enough, into ice. Can anything be clearer?

In our next we will endeavour to apply this simple illustration to the old doctrine of the expansion of matter during the absorption of heat, and its contraction whilst heat is evolved.

IMPROVED METROPOLITAN WATER SUPPLY.

A public meeting was held on Monday night, the 22d inst., in the Hanover-square Rooms, to take into consideration the best means of improving the whole water supply of the metropolis, and of placing its entire control in the hands of the inhabitants. Charles Lushington, Esq., M.P. for Westminster, occupied the chair; and Mr. Tabberner and a deputation from the Metropolitan Water Supply Association were in attendance to explain their plan for the attainment of the above object.

The Chairman stated the objects of the meeting, in the general purport of which he heartily concurred, as no one needed to be told that for some time past great complaints had been made of the supply of water to the metropolis being inadequate in quantity, impure in quality, and dear in price. He thought, therefore, it was the bounden duty of every inhabitant to endeavour to procure a remedy, especially as medical researches had shown that the pestilence which had lately been so severe in London was connected more or less with a deficient and impure supply in London. In the month of March last a bill was brought into the House of Commons for the promotion of the Henley-on-Thames Waterworks Company; and it was stated on that

occasion that there were not less than 60,000 houses in this metropolis that were unprovided with water—(Hear, hear). He had since been informed that subsequent calculations had carried the number up to 70,000 or 80,000 houses that were destitute of water. Something energetic should certainly be done to remedy this state of things; and with that view he had gladly obeyed the call of those gentlemen who had invited him to take part in these proceedings. He begged it, however, to be distinctly understood that he had not attended for the purpose of arraigning any body of men, or to advocate any particular plan—(Hear)—and he was the more anxious it should be understood that his judgment was reserved with regard to all matters that came before him, as these resolutions, if they were of any weight at all, must come ultimately before the House of Commons—(Applause).

Dr. Lankester moved the first resolution:—"That an abundant supply of pure water is one of the first necessaries of life and health; and that the present water supply of the metropolis is deficient in quantity, bad in quality, and obtainable only at such a price as practically to preclude in a great degree its being made available to the necessities of the poor; and that it has been proved, according to the most eminent medical testimony, that the present defective supply of water has greatly aggravated the fearful mortality with which this densely populated city has been lately visited." He entered at some length into the physical effects of water as applied to the skin, and also into the depressing effects, predisposing to disease, of the use of impure water. That the water generally supplied to the people of London was impure might be sufficiently inferred from the fact that most of the companies drew their supply from the Thames, which was the great outlet for vegetable and animal refuse, not only for London, but the other towns along its banks. The inhabitants on the south side of the river were supplied with water drawn from the filthiest part of the river, and other companies drew their supplies from greater distances, but all were more or less impure. Those houses that were supplied with water from wells were nearly as bad, as they were usually sunk a few feet below the surface, into which the sewer water almost invariably percolated. These objections did not apply to the artesian system of sinking for wells into the chalk strata below, where the water could be obtained pure; but there was this question still remaining to be solved, whether the supply to be derived from that source would be sufficient for the wants of the metropolis. All this, however, showed the necessity for such an inquiry as was proposed, and, therefore, he very cordially moved the resolution.

Dr. Aldis seconded the motion. It was calculated, he said, that 30,000,000 gallons of sewage-water were discharged daily into the Thames, independent of the dead cats and dogs and other refuse that constantly found their way into it. Surely no one could suppose that water derived from such a source could be fit for human use?—(Hear, hear.) He then stated some details of his own experience as a physician of the evils experienced by the poor from the inadequate supply of water, which, he said, it was calculated could be supplied to every house for the low charge of 1½d. per week.

Dr. E. D. Alison, district medical officer of Whitechapel Union, supported the resolution, and dwelt upon the hardships endured by the poor in his district from an inadequate supply of water, but in such a ludicrous manner that the meeting was kept in a roar of laughter throughout his speech.

The motion was then put, and carried unanimously.

Mr. Tabberner then came forward to explain the scheme of the Metropolitan Water Supply Association. After alluding to the various projects recently proposed to supply London with water, he said the object of this association was to keep aloof from them all, and first to endeavour to organize all London into one interest, with a view to break up the existing monopolies in the supply of water, by applying to Parliament to have a board of arbitration appointed to estimate the vested interests in the different companies, and to give them only what was their due. Then it was proposed to elect a commission, to be elected, not by the Government, but by each of the different parishes electing a commissioner or commissioners, in proportion to its population, with power to institute a scientific inquiry into the best method of supplying the whole of London with an abundance of pure water. That he thought might be done at a much cheaper cost than they were now paying for their inadequate and impure supply. It was calculated that the present water rates averaged 32s. per house. He was satisfied that for 8s. each of the 300,000 houses of London could have double their present supply of water, while 8s. more would suffice to pay off in the course of the next thirty years all that the existing companies could fairly claim in the way of compensation—(Applause). He was satisfied, if the matter should be warmly taken up, and petitions were to pour in from every parish, Parliament would not refuse them their request, for the vested interests of the companies would not have a leg to stand on.

Sir Charles Aldis thought this scheme appeared to be a very feasible one; and, for his part, he thought the best and purest supply would be derived from artesian wells. Doubts had been expressed whether they would yield a sufficient supply; but he was satisfied that, if they bled mother earth sufficiently, she would yield an abundant supply. Even in its present state he thought London as pure as any country village; and, if there was only a sufficient supply of water, he had no doubt it would be a model to any city on the face of the earth. He moved—"That, regarding water as one of the natural elements of life, this meeting cordially approves of the principles adopted by the Metropolitan Water Supply Association for ascertaining by scientific inquiry the most pure and abundant sources of supply, and the best mode of service at the least possible cost to the public, and of placing the control and management thereof under a public, popularly elective, and thereby a disinterested, board."

Dr. Garvey seconded the motion, and said it was obvious that the progress of civilization up to the present time had been adverse to the interests of the working classes, and fraught with the most disastrous consequence to them—(Applause). Could it be matter of wonder that the working classes were discontented? All efforts to raise the people morally would be useless so long as they were surrounded with objects that debased and degraded them. He made these remarks in order that the meeting might make the question their own, and take it out of the hands of all companies and all corporations—(Applause). On these grounds he cordially supported the plan that had been laid before them.

The Chairman here stated that no fewer than six gentlemen had applied to him for leave to address the meeting—(Cries of "Oh, oh!" and "Hear, hear!"). He hoped the meeting would hear them patiently; and at the same time he trusted the gentlemen themselves would see the necessity of confining their observations within as brief a compass as possible. The first he would call upon was

Mr. Sanders, overseer of St. Martin's, who said he had long devoted his attention to the question of an increased supply of water. He had examined the prospectus of this company, and, though they professed to be perfectly independent, yet, on reading it, the meeting would find it was in favour of one project—that of the artesian wells. He was sorry that such a liberal association should take a one-sided view of this important matter—(Hear, hear). He hoped the meeting would not allow themselves to be led away by any argument whatever—(Laughter). He believed that the contents of cesspools sunk down into the lower strata of the earth, and there was every likelihood of their sinking into the artesian wells—(Question, question!).

Mr. Mott rose to order, as the meeting was not called to discuss any system of supplying water.

Mr. Tabberner said the gentleman who had raised this question was a Henley-on-Thames gentleman—(Oh, oh!).

Mr. Sanders attempted again to address the meeting, and said he had no connection whatever with the Henley scheme. He objected to the proposed scheme so far as it professed that the water company should be under the control of the public. He believed that private companies would supply water at a cheaper cost than public would be likely to do; at the same time he thought the public should be so far interested in the matter that local sanitary boards should be appointed to see that every house in a parish was properly supplied with water at low prices. He would recommend the public not to trust this association more than any existing ones, but for every man to take up the question for himself; for he was satisfied that this association was just as liable to abuse as any other—(Loud applause). He then began to eulogize the Henley scheme as most likely to deal a deathblow to Mr. Tabberner's artesian scheme, for the meeting must remember that Mr. Tabberner was not an unprejudiced man: he was deeply committed by speaking and writing to the artesian scheme—(Laughter and applause).

The Very Rev. the Dean of Westminster rose, and was received with loud applause. He said he had attended the meeting urged by two important considerations—first, as Dean of Westminster, and guardian of a large amount of property possessed by that establishment in the metropolis; but he also attended as a private individual inhabiting the metropolis, and deeply sympathizing with the wants and miseries of his fellow-inhabitants in this colossal city. He had come to tender to the meeting the result of some thirty or forty years' attentive consideration of the best means of affording a supply of water, not to this metropolis alone, but to every city and kingdom on the surface of the habitable globe—(Hear, hear). It was matter of history that so long ago as 1836 he had published in his "Bridgewater Treatise" a long chapter exclusively devoted to the subject of supplying water from the regions of the earth, which no living man had ever dared to assail—which had been under the examination of the civil engineers of London and the Academy of Paris—without any one disproving it; and he appealed to that chapter in evidence of the difficulty of discovering as of applying to this great metropolis a sufficient quantity of water drawn from the subterranean strata, beneath what was called the London basin. It was a fact that the quantity of water found in the artesian wells had gone on diminishing, save the first one that was dug. There was one dug at Norland-house; another at the Botanical Gardens, at Kensington; another at the Bishop of London's Palace, at Fulham; another at one of the breweries; and, as each new well was bored contiguous to an existing well, it lowered the level of the preceding well from ten to twenty feet—(Hear, hear). In support of these facts he appealed to the chapter in the work already referred to, and which it would be his duty to republish—he appealed to a discussion which took place in the British Association for the Promotion of Science on the subject of artesian wells—he appealed to a discussion which took place in the College of Civil Engineers, in Great George-street, and when it was the unanimous opinion of the civil engineers of England that an adequate supply of water for the metropolis could not be obtained through the medium of artesian wells—(Applause). He appealed also to the opinion of Robert Stephenson—a name consecrated in the scientific annals of the universe, and who had lately triumphed in overriding the Menai Straits; when he was applied to for an opinion on the experiment of bringing the Colne water from Watford into London, he remarked, "the foregoing remarks

will tend to show that the proposition of penetrating the London clay for the purpose of obtaining water sufficient for the general supply of the inhabitants of London could not be attended with the advantages which at first sight it might appear to be possessed of." Of course this was not a fit subject for a general meeting, and, therefore, it was his intention to give a lecture upon the subject, and if he could get no other place he would ask leave to deliver it at the Royal Institution of Great Britain, which would, of course, be printed, and he would challenge all the engineers in the kingdom to disprove the results he should there bring forward—results which were maintained not by himself only, but by such men as Humboldt, by Arago, by Von Bach, and in this country he might mention the distinguished gentleman who was at the head of the Government Ordnance Survey, Sir Henry De la Beche—(Hear, hear). They were not, as was maintained by some philosophers fifty years ago, standing upon a bridge which arched over a subterranean abyss of waters. No; they were standing on water, indeed, but it was water dispersed through the earth like water dispersed through the cargo of a leaky vessel. There was land and water, and clay and water; and, in the present case, there was chalk and water; and it was only the crevices in the chalk that afforded receptacles for the water. The mean space of these crevices was calculated to be 1-25th part of the bulk of the water, which, it must be remembered, must be drawn to the surface by the costly experiment of steam, and from these facts the meeting would see that it was physically impossible that the fifty or sixty millions of gallons that were said to be necessary for the consumption of the inhabitants could be derived from these wells. The very rev. the dean explained that he had been induced to make these observations by the circumstance that the prospectus of the proposed association expressed an opinion in favour of obtaining a supply from artesian wells; but, it being explained to him that the resolutions before the meeting had nothing to do with the prospectus, he said he would refrain from moving any amendment.

Mr. Bouquet recommended, as the best source of supply, river water uncontaminated with sewerage. He also proposed that the water supply should be under the control of the Legislature, rather than of the parish authorities, who, he thought, were incurably addicted to jobbing.

Mr. Payne said he came from the southern side of the water, where the people were compelled to drink the water directly from that elongated sewer the Thames. He was lately speaking to the turncock in his neighbourhood of the water being so thick, when he received the reply that that was no matter of wonder, for, according to the principle now adopted of flushing the sewers, the water was no sooner up than it was down again—(Laughter and cries of "Hear, hear!"). He trusted, therefore, that the inhabitants of this aristocratic district would help their poor neighbours on the south side—(Hear, hear).

Mr. George Palliser, one of the board of guardians of St. Luke's, denounced the proposed company as no better than those companies now existing. No doubt the prospectus of this company attacked the six gigantic companies now existing, which reminded him of that passage in Scripture where the musicians' rods—[A voice: The magicians']—yes, the magicians' rods—(great laughter)—the magicians' rods were thrown down, and Aaron's rod swallowed them all up—(Applause). So this company proposed to swallow up all the existing companies, and then cried, look at our disinterestedness. What, then, were they to do?—(Hear.) He suggested that every part of London should elect delegates, who would meet together and take scientific advice, as to the best mode of obtaining a supply of pure water, leaving the question open whether the control should be in the Government or in the inhabitants. They would then be able to go to Parliament and have a parliamentary inquiry on the subject—(Applause). He dissented from the plan of compensating old companies; he thought a new company ought to be formed and supersede them altogether—(Applause).

Mr. Acland, secretary of the London Water Consumers' Company, objected to the resolution embracing the whole of the metropolis. He suggested doubts whether the observations of the Very Rev. the Dean of Westminster would be found to be borne out when the matter came to be practically tested. He was connected with a company which proposed to supply the City with an abundant supply of water from artesian wells, and their engineer had undertaken to supply every house in the City with 100 gallons a day from artesian wells—(Hear, hear). He, therefore, suggested that the City should be left out of this resolution. With that reservation, he would recommend the meeting to support this association as a step in the right direction.

Mr. Wm. Hall said he was owner of an artesian well which was 275 feet deep—seventy-five of them being in the chalk. From his experience he was satisfied that if the meeting expected to get a supply from that source they would be disappointed. He had to sink the well twice, the water being withdrawn in the first instance, and the machinery was constantly going wrong. He had, therefore, to warn the meeting not to rely on this source of supplying water.

Mr. Hoggins said the association was not committed to any principle, and therefore ought not to be condemned even though the artesian wells should be found to be insufficient. He, therefore, hoped the meeting would support the resolution.

The resolution was then put and carried by a very large majority.

Mr. Hargrave Mann proposed the next resolution, which he thought would so commend itself to the judgment of every individual that he need say nothing in support of it. He moved—"That it is desirable that each of the metropolitan parishes should organize a local movement in support of the Metropolitan Water Supply Association; and also, that a public subscription be forthwith entered into for the purpose of defraying all necessary expenses in carrying into effective operation the propositions of the association."

Mr. Neville Warren seconded the resolution, which was also carried.

Mr. Luke Hansard then moved a vote of thanks to the chairman, which was carried by acclamation, and the meeting separated.

PURIFICATION OF THE RIVER THAMES.

On Monday, the 22d inst., Mr. Dover, of New-street, Spring-gardens, the projector of a scheme for deputrifying the sewage of London, in order to prevent the contamination of the river by the sewers, and the consequent evils to public health which flow from its pollution, gave a further exhibition of his experiments for testing the soundness of his views. The outlines of Mr. Dover's plan have already appeared in this journal; but we may mention that it is proposed to construct works at the exit of each sewer into the Thames to intercept the sewage, and effect its deodorization and filtration, and, after undergoing this twofold process, the water will be allowed freely to discharge itself into the river. The sewage is to be pumped up by steam power into tanks or vats, of 1,000 to 3,000 gallons each, and disinfected progressively whilst filling. As soon as the tank is full the contents will be ready for filtering by ascent, and then the residuum is to be removed from the works in order to be converted into an inodorous fertilizer termed "British guano," the value of which is estimated as more than equivalent to the outlay upon works, machinery, and labour necessary for producing it. The experiment on this occasion was made upon a quantity of pestilential sewage taken in the presence of some of the spectators from an adjacent sewer; and the result was that the water came forth from the apparatus apparently effectually deputrified, but still retaining an acid taste and smell, attributable to the particular disinfecting agent employed. In this state we were assured that the effect of the water upon the human frame would be rather medicinal than otherwise. It is not quite so clear as the water supplied by the different metropolitan companies, but still it is fully adapted to the grand and paramount purpose of keeping the river free from its present deleterious impurities; and when mixed with the limpid stream flowing down from the lock at Teddington, in the proportion which naturally flows from that source, it is considered that the innocuous acid taste and odour which we mentioned above will be greatly diminished. Upon the whole the experiment — which was very simple, and conducted with the most perfect candour and openness—proved successful.

HEALTH OF LONDON DURING THE WEEK.

[From the Registrar-General's Report.]

In the week ending last Saturday the number of deaths registered in London is 1,028, and shows a further decrease on the returns of previous weeks. The weekly average of five previous autumns, corrected for increase of population, is 1,162; the decrease on the average, as shown by the present return, amounts, therefore, to 134 deaths. This reduction of the mortality is greatest in the districts on the south side of the river; for the deaths of the week in this division were 276, whereas the average is 324. The mortality from cholera now rapidly approaches the average, the deaths having fallen from 110 in the previous week to 41 in the last. In the west districts they have declined from 15 to 4; in the north, from 7 to 1; in the central, from 10 to 6; in the east, from 32 to 17; and in the south from 46 to 13. There were five deaths in each of the districts of Shoreditch and Bethnal-green; in all others the number of fatal cases of the epidemic was still less. In the whole metropolis the daily number did not, in any instance, exceed 9; on Wednesday and Saturday it was only 5. The deaths from diarrhœa and dysentery were more numerous, and amounted in the week to 63; in the previous week they were 105. Of the 14,538 persons who have died of cholera in London in fifty-five weeks, 6,657, or nearly one half, died after less than one day's illness (exclusive of the duration of premonitory diarrhœa); and of the remainder, 2,466 sank under the disease before it had reached the second day.

At present smallpox and measles are much less fatal than usual; scarlatina was fatal in 41 cases, the average being 64; typhus in 63 cases, the average being 56.

The reading of the barometer reached 30.04 in. on Thursday at nine o'clock a.m.; the mean of the week was 29.89. The mean daily temperature increased from 43° on Sunday to 59° 7′ on Thursday, and continued at nearly this value during the rest of the week. The highest temperature was 69° 7′ on Friday. On the first three days of the week the mean temperature was below the average of corresponding days in seven years; in the last three days it was about 12° above the average. The mean of the week was 52° 4′.

How to Harden Gypsum.—It is known that calcined gypsum, after being moistened with a solution of alum and again burnt, acquires much greater hardness and solidity. M. Kreating recommends for the same purpose a solution of one pound of borax in nine pounds of water, which is poured over the calcined fragments of gypsum. They are then kept at a strong red heat for six hours, ground to a powder, and worked. The effect is said to be still better if a pound of tartar and twice the quantity of water are added to the solution.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

James Childs, Earl's-court-road, Old Brompton, Middlesex, wax-bleacher, for improvements in the manufacture of candles, night lights, and candle lamps. Patent dated April 16th, 1849. Enrolled October 16th, 1849.

These improvements consist—

1. In bleaching palm oil, tallow, and fatty bodies by the application of oxide of chlorine, in the following manner:—One ton of palm oil is heated to a boiling-point in wooden vessels by free steam, then allowed to settle, and mixed with two lbs. of chlorate of potass, four quarts of sulphuric acid, sp. gr. 1.1, diluted with an equal quantity of water. It is then boiled for twenty minutes, and one pint of sulphuric acid, likewise diluted with water, added to it; after which it is allowed to cool, when it is ready for use.

2. In coating the wicks of tallow candles which do not require snuffing with stearic acid.

3. In making the night lights of different materials in horizontal strata—the top one of a long-consuming and consequently expensive substance, and the bottom one of a quicker-consuming and cheaper substance.

4. In constructing the cases or boxes of night lights of wood instead of paper, as heretofore; or,

5. Constructing the cases of sheet metal, which, from its indestructibility, will prove (so it is stated) more economical than either the preceding or any other method.

6. In manufacturing the nozzles of candle-lamps of glass or earthenware instead of metal, in order to prevent as much as possible the communication of heat from the flame to the tallow.

Claims.—1. Bleaching palm oil, tallow, and other fatty bodies by means of oxide of chlorine.

2. Coating the wicks of tallow candles which do not require snuffing with stearic acid.

3. Making night lights of different materials in strata.

4. Making the cases or boxes of night lights of wood, or,

5. Of metal.

6. Manufacturing the nozzles of candle lamps of glass or earthenware.

Thomas Cocksey, Little Bolton, Lancaster, millwright, and James Nightingale, of Brightines, in the same county, bleacher, for certain machinery to facilitate the washing and cleansing of cotton and other fabrics, which machinery is applicable to certain operations in bleaching, dyeing, printing, and sizing warp and piece goods. Patent dated April 16th, 1849. Enrolled October 16th, 1849.

This machinery consists of a long trough filled with water, above the surface of which a number of beaters and angular carriers are arranged alternately and supported on axles passing through the sides. Beneath the beaters and carriers, and immersed in the water, are a like number of rollers. The beaters consist each of two leaves, so that at each revolution they strike the fabric twice, and are made to rotate by the intervention of toothed gearing from any prime mover, while the only motion communicated to the carriers and rollers is that which results from the passage of the fabric over their peripheries. The fabric is passed over the carrier, nearest to the outflow end of the trough, under the immersed roller, then over the beater, afterwards under another immersed roller, and so on throughout the series—travelling in a direction the opposite to that of the current, in order that as it becomes cleansed it may encounter cleaner water. When the fabric is slight the beaters are driven at a reduced speed by the application of clutch-boxes to their axles. The fabric is drawn between a pair of pressing rollers, and, lastly, wound upon another roller to be ready for use. This machinery may, it is stated, be readily applied in the bleaching, dyeing, printing, and sizing of warps and piece goods.

Claims.—1. Combining a number of beaters with a trough, so as to cause the fabric to descend into and ascend from the water successively.

2. Combining a series of angular carriers with a succession of beaters, as described.

3. The application of clutch-boxes to the axles of the beaters, for the purpose of reducing their speed.

William Little, Strand, for improvements in the manufacture of materials for lubricating machinery. Patent dated April 16th, 1849. Enrolled October 16th, 1849.

These improvements consist in the application of the products brought over by the distillation of petroleum as a lubricating substance in combination with other materials. The petroleum is distilled in a retort, and the greasy products are mixed in the proportion of 45 parts to 32 parts of tallow, 75 parts of soda ley (10° to 11° Beaumé), and 29 parts of water, when in the state of saponification.

Claim.—The manufacture of lubricating matters for machinery by the application of the products of petroleum.

William Henry Phillips, York-terrace, Camberwell New-road, Surrey, engineer, for improvements in extinguishing fire, in the preparation of materials to be used for that purpose, and improvements to assist in saving life and property. Patent dated April 16th, 1849. Enrolled October 16th, 1849.

Mr. Phillips's present invention refers, firstly, to the mode of constructing apparatus in which is generated the gas to be applied to extinguish fire, and which was the subject of a former patent; and, secondly, to the preparation of the material by the ignition of which the gas is generated.

1. The material, consisting of equal parts of chlorate of potass, and sugared and moulded into a homogeneous mass, is placed in a perforated cylinder within a second perforated cylinder, contained in a third cylinder, which is air-tight, and the whole is enclosed in an outer casing. Water is placed in the space between the bottoms of the third cylinder and outer casing, which is fitted with a vertical pipe which opens into the space between the second and third cylinders, so that as the metal expands from the application of heat the water will be forced up the pipe and made to mingle with gas, which will afterwards escape through an opening in the top of the case. The "material" is ignited by driving a pin down into the midst of it. The patentee describes several modifications of the preceding apparatus, among which is one wherein steam is applied to exhaust the gas, and turpentine poured in to promote the combustion of the material.

2. Instead of mixing the materials with water and moulding them into form, the patentee proposes to boil them in water, and evaporate a portion of it, so that the mass may be in a plastic state and easily moulded into the desired form.

Claims.—1. The improvement in apparatus for extinguishing fire.

2. The mode of preparing the materials employed for that purpose.

Henry Bessemer, of Baxter-house, Old St. Pancras-road, engineer, for improvements in the modes of extracting saccharine juices from the sugar-cane, and in the manufacture of sugar, as also in the machinery or apparatus employed therein. Patent dated April 17th, 1849. Enrolled October 17th, 1849.

I. Mr. Bessemer describes and claims, firstly, a cane-press, of which the following are the principal characteristics:—

1. The machinery for expressing the saccharine juice is combined in one framework with the steam machinery for working the same.

2. The canes are passed through perforated tubes laid longitudinally, and left open at the discharge end—the necessary resistance to the expressing piston being obtained by the friction of the canes against the interior sides of the tubes.

3. The canes are cut into lengths adapted to the size of the containing tubes, by means of the same pistons, by which they are immediately afterwards pressed. And

4. The reciprocating movements of a steam driving piston are combined in a novel and exceedingly ingenious manner with those of two expressing pistons, whereby the latter are made to exert throughout each stroke a gradually increased pressure with a gradually diminishing velocity.

II. An improved apparatus is also described and claimed for heating and regulating the temperature of the cane-juice in its progress from the cane-press to the defecating vessel.

Alexander Alliott, of Lenton Works, Nottingham, bleacher, for improvements in apparatus for ascertaining and for marking or registering the force or pressure of wind, of water, and of steam, the weight of goods or substances, and the velocity of carriages; also an apparatus for ascertaining, under certain circumstances, the length of time elapsed after carriages have passed any given place, and for enabling the place or direction of floating bodies to be ascertained. Patent dated April 17th, 1849. Enrolled October 17th, 1849.

Claims.—1. The employment of an independent column of air to transmit or communicate the force of wind (natural and artificial) to a registering apparatus.

2. A flexible diaphragm (which acts on the column of air) of vulcanized indiarubber, of a peculiar form, which is figured and described.

3. A registering apparatus on a new plan.

4. An air-pressure registering apparatus.

5. The adaptation of the apparatus (1) to ascertaining and registering the force or pressure of water.

6. The adaptation of the apparatus (3) to steam.

7. Another.

8. An improved weighing-machine, of which the chief peculiarity is, the employment of wheelwork carrying numbering plates and index hands, that are moved in proportion to the elongation of a spring, but which is at the same time so disconnected that the power required to move the wheelwork shall produce no effect on the spring.

9. An improved method of moving, by machinery, the weight on the steelyard of steelyard weighing-machines.

10. Another method of effecting the preceding object.

11. A third method of ditto.

12. The employment in weighing-machines of a system of numbering wheels for printing and registering the weights as ascertained.

13. The employment of fluids, in a peculiar manner, to ascertain and regulate the velocity of carriages.

14. An apparatus for ascertaining the length of time which has elapsed after a train of carriages has passed any given point.

15. The construction, for the purpose of ascertaining the place or direction of floating bodies, of the mariner's compass, with chemically-prepared paper moved by suitable clockwork.

John Ruthven, engineer, Edinburgh, Scotland, for improvements in preserving lives and property from water and fire, and in producing pressure for various useful purposes. Patent dated April 16th, 1849. Enrolled October 17th, 1849.

1. Mr. Ruthven proposes to build a water-tank, either on the roof of the house or on an eminence at any convenient distance from it, and to have a pipe, similar to a gas-pipe, running down the front of the house, with an outlet-pipe opposite a window in each story. The ends of these pipes are threaded, in order that a flexible pipe of gutta percha or indiarubber, or other waterproof material, fitted with a di-

rector at the other end, may be screwed on as required.

2. The patentee next describes a portable fire-extinguisher, which is constructed of a vessel to which water is supplied from any convenient source, above which is a cylinder containing a piston worked up and down by a rack and pinion. A valve, opening upwards, is fixed in the pipe between the vessel and cylinder. At the side of the cylinder is an air-vessel, with a one-way valved pipe communicating with the cylinder, and fitted with a flexible pipe, whereby the water is conducted in any required direction as it is forced out.

3. A life-preserver follows, which consists of an air-tight bag constructed to fit into a hat, travelling-bag, &c., which is provided with a short flexible pipe and valve opening inwards when air is blown, and closing of itself when that pressure is removed, in order to allow of free respiration.

4. An improved press is next described, which consists of a bed-plate with two pillars (one of which is slotted) fixed to the two opposite ends. A beam lever is bolted in the fork of the solid pillar, and carries in the centre a connecting rod which is attached to the top plate. The other end of the lever is bolted to a connecting rod, which is attached to the bottom of a curved lever, provided with a handle, so that the depression of the latter forces the beam lever downwards, and consequently the top plate upon the bed-plate.

Claims.—1. As regards the arrangement of apparatus for preserving life from fire, the screw couplings, stopcocks, and flexible pipes of some impermeable material.

2. In respect to the portable fire-extinguisher, not the form, but the arrangements for producing the effect.

3. Inflating with air water-tight bags, adapted to hats, bags, &c., and the employment of the one-way valve.

4. As regards the means of producing pressure, not the form, but the arrangements for producing the effect.

Charles Shepherd, Leadenhall-street, London, chronometer-maker, for certain improvements in working clocks and other timekeepers, telegraphs, and machinery by electricity. Patent dated April 16th, 1849. Enrolled October 16th, 1849.

Claims.—1. The employment in chronometers of apparatus actuated by electro-magnetism for winding up the remontoir escapement, which is retained by a detent.

2. Giving audible signals in chronometers, by means of a locking plate, and apparatus connected therewith, worked by electro-magnetism.

3. An arrangement of apparatus for making and breaking the circuit.

4. A peculiar arrangement and adaptation of apparatus, worked by electro-magnetism, to chronometers.

5. The combination in chronometers and telegraphs of two pallets and detents for giving the step-by-step motion.

William Hyde Knapp, Long-lane, Southwark, chemist, for improvements in preparing wood for the purposes of matches and firewood. Patent dated April 17th, 1849. Enrolled October 17th, 1849.

Claim.—A mode of preparing wood for matches and firewood by immersing it in rosin oil.

William Edward Newton, Chancery-lane, civil engineer, for improvements in boilers and steam generators. (Being a communication.) Patent dated April 17th, 1849. Enrolled October 17th, 1849.

This invention applies to steam-boilers in which the tubes are used as water-passages instead of smoke-flues, &c., and consists in curving one of the ends, and causing it to pass through the crown to nearly the top of the water, to allow for the expansion of the metal. The other ends are supported in a vertical plate behind the chimney, and open into the boiler. The turned-up ends are fixed over the furnace, in order that the water may travel in a direction opposite the current of the products of combustion.

Claim.—Making the water tubes or pipes of steam boilers or generators with one of the ends curved or turned upwards, and with both ends communicating with the water in the boiler.

George Remington, Warkworth, Northumberland, civil engineer, for certain improvements in locomotive, marine, and stationary steam-engines, and in hydraulic and pneumatic engines. Patent dated April 17th, 1849. Enrolled October 17th, 1849.

The principal features of Mr. Remington's numerous improvements and modifications (illustrated by fifty-one drawings) are:—

1. A mode of converting rectilineal into rotary motion, by causing a stud fixed on the piston to take into an endless groove cut on the inside periphery of a hollow tube, at acute or oblique angles to its central axis. The tube passes through stuffing-boxes in the cylinder covers and piston. The arrangement for converting rotary into rectilineal motion is the converse of the preceding one.

2. A steam-valve, consisting of a cylinder closed at one end, and divided into two compartments by a central partition, the other end of which is ground smooth to fit concentrically on the steam-chest, which is divided into four equal compartments, so that as the valve revolves the steam will flow up the first compartment and down the second into one end of the cylinder, while the steam on the other side of the piston will flow up the third compartment and escape to the exhaust down the fourth. The continued revolution of the valve will cause the steam to enter the previously exhausted end of the cylinder. This valve gearing is constructed on the same principle as first described.

3. An arrangement for dispensing with the use of the hollow pipe by means of a rod attached to the piston and crank-pin, which vibrates in an opening in the top of the cylinder. This opening is closed by a flat valve, which carries a gland through which the rod passes.

4. A mode of constructing double-cylinder engines by employing two concentric cylinders, the space between the outside and inside peripheries being fitted with an annular piston having two rods connected to cranks set at right angles to the central one.

5. Various modes of centring oscillating cylinders on solid trunnions, and admitting and exhausting the steam through jointed pipes.

Mr. Remington's claims are so numerous and voluminous, and refer so repeatedly to arrangements shown in the drawings, that we must decline repeating them, except the first of the final eight, which is, by-the-by, sufficiently comprehensive:—

"All the arrangements of locomotive, marine, and stationary steam-engines, and hydraulic and pneumatic engines, as described in the specification and represented in the accompanying drawings."—*Mechanics' Magazine.*

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS FOR THE WEEK ENDING OCTOBER 12, 1849.

William Jamieson, of Ashton-under-Lyne, in the county of Lancaster, machine-maker, for certain improvements in looms for weaving. Patent dated October 4th, 1849; six months.

Charles Attwood, of Tow-law Ironworks, near Darlington, in the county of Durham, Esq., for an improvement or improvements in the manufacture of iron. Patent dated October 5th, 1849; six months. (Communication.)

William Edward Newton, of Chancery-lane, for improvements in machinery for planing, tonguing, and grooving boards or planks. Patent dated October 5th, 1849; six months.

Alfred Vincent Newton, of Chancery-lane, for improvements in the manufacture of pipes or tubes. Patent dated October 5th, 1849; six months.

Henry Watson, of the town of Newcastle-upon-Tyne, brassfounder, for improvements in valves and cocks. Patent dated October 12th, 1849; six months.

Robert Lakin, of Ardwick, in the county of Lancaster, machinist, and William Henry Rhode, of Openshaw, in the county of Lancaster, mechanist, for certain improvements in machinery, and for preparing, spinning, doubling, and weaving cotton, and other fibrous substances. Patent dated October 12th, 1849; six months.

Peter Armand le Comte de Fontainemoreau, of South-street, Finsbury, for improvements in spinning fibrous substances. Patent dated October 12th, 1849; six months. (Communication.)

Joseph Low, of Salford, in the county of Lancaster, surveyor, for certain improvements in grates or grids applicable to sewers, drains, and other similar purposes. Patent dated October 12th, 1849; six months.

Richard Fitch, of Chelmsford, in the county of Essex, patent salt-manufacturer, for improvements in baking bread, biscuits, and other matters, which improvements are applicable for drying goods. Patent dated October 12th, 1849; six months.

Cornelius Borrel, of Kempsey, in the county of Worcester, engineer, for certain improvements in rotary engines, to be worked by steam or other means; and also in the construction of carriages, vessels, or other vehicles, to be worked or propelled by the said improvements in rotary engines or other motive power, and for the machinery to be connected therewith. Patent dated October 12th, 1849; six months.

James Banister, of Birmingham, manufacturer, for a certain improvement or certain improvements in tubes for locomotive and other boilers. Patent dated October 12th, 1849; six months.

George Alois Kingeisen, of Essex-street, Strand, in the county of Middlesex, chemist, for a composition or preparation for destroying vermin. Patent dated October 12th, 1849; six months.

Charles Rowley, of Newhall-street, Birmingham, button-manufacturer, for certain improvements in apparatus for weaving, and in articles to be attached to dresses. Patent dated October 12th, 1849; six months.

John Torkington, of Bury, in the county of Lancaster, railway contractor, for certain improvements in the construction of chairs for railways. Patent dated October 12th, 1849; six months.

John Christophers, of Heavitree, in the county of Devon, formerly merchant and shipowner, for improvements in naval architecture. Patent dated October 12th, 1849; six months.

Thomas Lightfoot, of Broad Oak, in the county of Lancaster, chemist, for improvements in printing cotton fabrics. Patent dated October 12th, 1849; six months.

William Stedman Gillett, of Wilton-street, Grosvenor-place, Esq., for improvements in packing-pistons, stuffing-boxes, slides, and other parts of machinery; and in forming bearings, and in making cylinders and other forms of metal. Patent dated October 12th, 1849; six months.

Conrad William Tinzel, of the city and county of Bristol, sugar-refiner, for improvements in the processes and machinery employed in, and applicable to, the manufacture of sugar. Patent dated October 12th, 1849; six months.

John Mercer, of Oakenshaw, in the county of Lancaster, gentleman, and William Blythe, of Holland-bank, in the same county, manufacturing chemist, for improvements in certain materials to be used in the processes of dyeing and printing. Patent dated October 12th, 1849; six months.

Jules le Bastier, of Paris, gentleman, for certain improvements in machinery or apparatus

for printing. Patent dated October 12th, 1849; six months.

Joseph Johnson, of Huddersfield, in the county of York, bricklayer, and Joe Cliffe, of the same place, ironfounder, for improvements in furnaces, or in the means of consuming smoke. Patent dated October 12th, 1849; six months.

LIST OF ENGLISH PATENTS GRANTED FOR THE WEEK ENDING OCTOBER 18, 1849.

John Debell Tuckett, of Plymouth, in the county of Devon, merchant, for a new and improved method of preparing a manure called "superphosphate of lime." Patent dated October 18th, 1849; two months.

Thomas Dawson, of Melton-street, Euston-square, machinist, for improvements in cutting and shaping garments, and other articles of dress for the human body. Patent dated October 18th, 1849; six months.

George Shove, of Deptford, in the county of Kent, for improvements in manufacturing ornamented surfaces when glass and other substances are used. Patent dated October 18th, 1849; six months.—(Communication.)

Joseph Stovel, of Suffolk-place, Pall-mall East, in the county of Middlesex, tailor, for improvements in coats, parts of which improvements are applicable to sleeves of other garments. Patent dated October 18th, 1849; six months.

David Hulett, of Holborn, in the county of Middlesex, gas engineer, and John Birch Paddon, of Lambeth, gas engineer, for improvements in gas-meters and gas-regulators. Patent dated October 18th, 1849; six months.

Ethan Campbell, of the city of New York, in the United States of America, philosophical, practical, and experimental engineer, and a citizen of the said United States, for certain new and useful improvements in the means of generating and applying motive power, and in propelling vessels. Patent dated October 18th, 1849; six months.

William Wyatt, of Waterloo Cottage, Oldswinford, in the county of Worcester, pumpmaker, for improvements in coating the surfaces of pumps, pipes, cisterns, and other articles of iron. Patent dated October 18th, 1849; six months.

Charles Felton Kirkman, of Argyle-street, in the county of Middlesex, gentleman, for certain improvements in machinery for spinning or twisting cotton, wool, or other fibrous substances. Patent dated October 18th, 1849; six months.

PATENTS RECENTLY EXPIRED.

C. P. Devaux, London, merchant, for certain improvements in smelting iron stone or iron ore. Patent dated October 8th, 1835. Expired October 8th, 1849. (Communication.)

A. Howard, of Stockport, cotton-spinner, and J. Seattergood, for improvements in looms for weaving, whether worked by hand or other power. Patent dated October 8th, 1835. Expired October 8th, 1849.

T. Jevons, Liverpool, merchant, for certain improved machinery to be used in manufacturing bar or wrought iron into shoes for horses, and also into shapes for other purposes. Patent dated October 8th, 1835. Expired October 8th, 1849. (Communication.)

R. Jupe, London, upholsterer, for improvements in ornamental dessert flower and other stands. Patent dated October 9th, 1835. Expired October 9th, 1849.

J. W. Fraser, London, artist, for improvements in raising weights or substances from below to the surface of the water. Patent dated October 15th, 1835. Expired October 15th, 1849.

J. Bird, Birmingham, gentleman, for an improved method of making and compounding printers' ink, paints, and other pigments. Patent dated October 15th, 1835. Expired October 15th, 1849.

S. Draper, lace-manufacturer, for improvements in producing plain and ornamental weavings. Patent dated October 15th, 1835. Expired October 15th, 1849.

ROYAL COLLEGE OF VETERINARY SURGEONS.—The following gentlemen, having undergone the necessary examinations for the diploma before the Court of Examiners, appointed under the charter, have this year been admitted members of the college:—Thomas Cade, Devon; William Lockhart, Glasgow; Edward Evanson Ashe, Cork; Charles Edward Barton, Coventry; John Finlayson M'Gill, Ayrshire; William Aitken, Edinburgh; Thomas Secker, Knaresborough; Charles Barker, William Stephenson, Thornton, Yorkshire; Alexander Robinson, Greenock; John Roalfe Cox, London; Whitfield Smith, Liverpool; William East, Aylesbury; William Clark, London; Richard Stone Blake, Castle Carey; Edward Garton, Loughborough; Stephen Evershed, Richard Barker, Middlewich; Thomas John Williamson, London; Alfred John Shorten, Ipswich; John Gates, Prescot; Edward Simpson Shove, Sudbury; Thomas Johns, St. Pancras; Matthew Stone, Wentworth; James Wright, Burnham Overy; Jeffrey Dawtrey, Petworth; John Davis Barford, Gayhurst; Alexander Mavor, London; Robert Gibton, Charles Turner, Carshalton; Thomas Cunliffe, Blackburn; Richard Glengall Kelly, Borrisokane; John Magrath, Castlebellingham; John Humphreys Lane, Goulton; Joseph Sampson Gamgee, St. Pancras; Forbes A. Hely, Hounslow; William Thomas O'Donnell, Henry Michael Hancock, Ealing; Joseph Lawrence, India; Thomas Turner, jun., Croydon; William Cooper, Berkhampstead; Thomas Swainson Griffiths, London; Henry W. Cannell, Liverpool; John Samuel Woods, London; Joseph Reeve, Outwell; William Wallace, jun., Wolverhampton; Thomas Daniel Willshire, Merthyr Tydvil.

APOTHECARIES'-HALL.—Names of gentlemen who passed their examination in the science and practice of medicine, and received certificates to practise, on Thursday, Oct. 18, 1849:—David Morgan, Llandilo, Carmarthenshire; Josiah Pritchard, Milbourne, Wilts; Hay Sharpley, Louth, Lincolnshire.

THE FUNGOID THEORY OF CHOLERA.—On Wednesday, the 17th inst., at a meeting of the London Microscopical Society, the president, Mr. Busk, made some remarks with respect to the lately-propounded theory which attributes the cholera to the presence of living organisms of a fungous character in the stomach and intestines. The conclusions upon this subject at which Mr. Busk had arrived, and which were supported by the exhibition of drawings and specimens, were—1. That in the discharges of cholera there are no peculiar organisms. 2. That those bodies which had been supposed to be of such a nature were either the remains of farinaceous particles of food, including the bran part of wheat or other cereal grains, or foreign organisms conveyed by the medium of the food. 3. And consequently that there was no foundation for the "fungoid theory of cholera."—*Globe.*

THE CHOLERA IN PARIS.—The *Union Médieale* of Paris says:—"We may now (Friday, the 19th inst.) consider the epidemic as entirely over. For the last two days not a single case has been admitted into the hospitals or civil asylums, and the number of cases registered in the *salles* is only two. The number of deaths in the same space of time only amounted to three. We shall, under these circumstances, cease to publish our usual bulletin of the cholera. A weekly review of the progress of the disease will still appear until it have entirely ceased. The cholera has too much declined to render a daily bulletin interesting."

THE CROSS-BONES BURIAL-GROUND.—On Monday night, the 22d inst., an adjourned meeting of the churchwardens, overseers, and other residents of St. Saviour's, Southwark, was held in the vestry-room, for the purpose of considering certain instructions recently issued by the Board of Health, in reference to future interments in the Cross-bones burial-ground. In the course of the discussion which ensued, some of the speakers expressed a strong opinion that no burials ought to be permitted within large towns, and also a hope, in reference to the instructions of the Board of Health, that the particular one requiring lead coffins deposited in brick graves or vaults to be soldered up so as to be perfectly air-tight would not be insisted on. Ultimately it was moved and seconded that the instructions of the Board of Health should be complied with; but, this motion being withdrawn, the following one was substituted and adopted:—"That the wardens be empowered to communicate with the Board of Health upon the subject of the Cross-bones burial-ground, in order to obtain their consent to a variation of their order, to allow of the use of the maiden earth in the said ground for burials until some legislative measure be passed for stopping intramural burials and providing necessary burying-ground, or, if needful, either to close the burial-ground entirely or comply with the order as they shall deem right.'

CRETA LÆVIS.—An article has been brought under our notice, under this designation, which, to our judgment, possesses considerable superiority over the ordinary crayon; whilst, at the same time, it has all the properties of that useful auxiliary to the arts. Mr. Wolff, of Spitalfields, who is the inventor, is well known as a maker of black-lead pencils; and, by much exertion, he has brought the creta lævis to a high state of perfection. Unlike crayons, the creta levis cannot be rubbed off the paper, and no water, brush, or palette is required, neither are the drawings affected by heat. The colour, being peculiarly clear and bright, is particularly adapted for flower paintings, and railway companies would find this material the most economical for their plans. We may safely recommend the creta lævis to all who are fond of the fine arts.

HIGH RAILWAY SPEED.—Within the last few days one of the largest engines on the Great Western Railway took a load of 170 tons down a portion of the line, with a falling gradient of only four feet, at a rate of 65 miles an hour.

CAPTURE OF THE ELECTRIC EEL.—But the crocodile and jaguar are not the only assailants of the South American horses; they have also a dangerous enemy among fishes. The marshy waters of Bera and Rastro are filled with numberless electric eels, which can, at pleasure, send a powerful discharge from any part of their slimy yellow-spotted bodies. These gymnoti are from five to six feet in length, and are powerful enough to kill the largest animals when they discharge their nervous organs at once in a favourable direction. The route from Uritucu through the Steppe was formerly obliged to be changed, because the gymnoti had increased to such numbers in a small stream that in crossing it many horses were drowned every year, either from the effects of the shocks they received, or from fright. All other fishes fly from the vicinity of these formidable eels. Even the fisherman, angling from the high bank, fears lest the damp line should convey the shock to him from a distance. Thus, in these regions, electric fire breaks forth from the bosom of the waters. The capture of the gymnoti affords a picturesque spectacle. Mules and horses are driven into a marsh which is closely surrounded by Indians, until the unwonton noise and disturbance induce the pugnacious fish to begin an attack. One sees them swimming about like serpents, and trying cunningly to glide under the bellies of the horses. Many of these are stunned by the force of the invisible blows; others, with manes standing on end, foaming, and with wild terror sparkling in their eyes, try to fly from the raging tempest. But the Indians, armed with long poles of bamboo, drive them back into the middle of the pool. Gradually the fury of the unequal strife begins to slacken. Like clouds which have discharged their electricity, the wearied fish begin to disperse; long repose and abundant food are required to replace the galvanic force which they have expended. Their shocks become gradually weaker and weaker. Terrified by the noise of

the trampling horses, they timidly approach the bank, where they are wounded by harpoons, and cautiously drawn on shore by non-conducting pieces of dry wood.—*Humboldt's Aspects of Nature.*

New Galvanic Battery.—Prof. Stohrer, of Leipsic, makes a powerful and compact battery as follows:—He employs zinc and charcoal cylinders. The cylinders are composed of coal and coke in powder, well mixed together, to which is added a sufficient quantity of coal-tar, to render the mass of a consistence suitable to be moulded. When dry the cylinders are placed in a muffle and submitted to a white heat. Every variety of shape may thus be obtained, and this substance would appear especially of service for sharp or pointed surfaces, as well on account of its durability as for the perfect homogeneousness of its grain. The zinc element in M. Stohrer's battery is amalgamated to prevent the rapid consumption of metal which would otherwise take place. With a battery of 2¾ inches in height, and cylinders of about 5 inches in diameter, an iron wire of the thickness of an ordinary sewing-needle may be melted, as also a watch-spring; it will communicate a magnetic power capable of sustaining 220 pounds. M. Stohrer makes use of electro-magnets thus formed to form the steel magnets of the electro-magnetic machines of his construction.

Method of Welding Iron, Steel, and Sheet Iron.—In an earthen vessel melt borax, and add to it 1-10th of sal-ammoniac. When these ingredients are properly fused and mixed, pour them out upon an iron plate and let them cool. There is thus obtained a glassy matter, to which is to be added an equal quantity of quicklime. The iron or steel which are to be soldered are first heated to redness; then this compound, first reduced to powder, is laid upon them; the composition melts and runs like sealing-wax. The pieces are next replaced in the fire, taking care to heat them at a temperature far below that usually employed in welding; they are then withdrawn and hammered, and the surfaces will be found to be thus perfectly united. The author asserts that this process, which may be applied to welding sheet-iron tubes, never fails.

Navigating the Air.—Mr. Penington, the original projector of a flying-machine to navigate the air, which has been noticed by us before, has returned from the far west, where he has been making some experiments on the great prairies. The Baltimore *Sun* regrets to say that he has not been sufficiently successful to enable him to come back in his own carriage. He is, however, sanguine of fully succeeding eventually in making a voyage to California, or even to Europe, in his car, through the air. A large machine of this kind is now building near this city by Mr. Robjohn. The canvass is all ready, and is about eighty yards in length and fifty in diameter. It is to be propelled by two oscillating five-horse power engines, which are already provided and secured in the car. They occupy a very small space and are well made. They are to propel the huge gaseous monster by fan-wheels, we believe. We await in calm contemplation the mighty results of this enterprise. We can say this much about it, that the workmanship will be well executed. The projector has at least great courage and deserves success—in any other department he would attain it.—*Scientific American.*

For Mending Steam-boilers, &c.—Mix two parts of finely powdered litharge with one part of very fine sand, and one part of quicklime, which has been allowed to slack spontaneously by exposure to the air. This mixture may be kept for any length of time without injury. In using it a portion is mixed into a paste with linseed oil, or, still better, boiled linseed oil. In this state it must be quickly applied, as it soon becomes hard.

Keene's Marble Cement.—Gypsum is baked in the same way as for making plaster of paris; it is then soaked in a saturated solution of alum; again baked to the same degree as before, and ground to a fine powder. It is now in a fit state for use. On being worked in the same way as plaster of paris, it sets into a very hard composition which is capable of taking a high polish. It may be coloured by mixing the powder with water containing any mineral colours, instead of common water.

Intramural Burials.—The General Board of Health have in preparation a general measure for the removal of all intramural interments from the metropolis. The tenor of their circular letters for information, and an express intimation to that effect in one of the circular letters to overseers and churchwardens, might have made that matter plain, if Parliament had not expressly charged them with the preparation of provisional orders to that effect, with the concurrence of the bishop of the diocese. We believe that the General Board of Health are proceeding with the entire concurrence of the Bishops of London and Winchester. It is the more necessary to state this, as proposals are being made to parishes for the purchase of burial-grounds, which can only have the effect of committing them to preliminary expenses and fruitless contests. Mr. Charles Pearson, the City solicitor, proposes that the corporation of the city of London should take up the subject of providing interments for the metropolis. The householders of the city who are not freemen (not to speak of the inhabitants of the metropolis generally) will hardly think that the maintainers of Smithfield Market and the opponents of the Public Health Act are yet sufficiently cleanhanded to claim the exercise of so large a trust. We do not wish to damp a new-born sanitary zeal. We would rather augment and direct it more efficiently. We would suggest that their best course of exertion is in the reduction of the total number of preventible deaths. In the year 1841 it was shown that in the city of London and in the East and West London Union there was an excess of 1,162 out of 3,469 deaths for the year 1839 above the rate of mortality in the healthier districts of Greenwich or Camberwell. Out of that excess of deaths, 425 of the class of artisans, 201 of the class of shopkeepers, and forty-nine of the class of professional persons or persons of independent means, were deaths from epidemic diseases. Mr. Simon, the officer of health, has shown, in a report which, for its independence, deserves high praise, that the City courts and alleys are often mere fever nests, and what are the removable causes of such excesses. The saving of 600 or 1,000 preventible deaths and funerals would be a work quite deserving of the undivided energies snd means of the corporation. Let them apply themselves with energy in the removal of the evils in the sanitary condition of their own population, and we and the public at large will forget the words of the resolution of the Court of Common Council that for cleanliness as well as for health the City could not be surpassed.—*Observer.*

Earthquake in Savoy.—Two severe shocks of earthquake were felt at Rochette, in Savoy, on the 1st of October, at half-past twelve o'clock a.m. An interval of one second separated the shocks. The earthquake was felt at the Marches, at Chamoux, and at St. Jean de Murienne.

Dispensaries, &c., in Ireland.—A parliamentary paper published on the motion of Sir William Somerville, the Secretary of State for Ireland, shows that the number of dispensaries, fever hospitals, and infirmaries for which county presentments were made in Ireland in the year 1848 amounted to 773 (against 813 in 1847); the amount of presentments was £83,508, and the amount of subscriptions £33,393, making a sum total of £116,902. The total amount of the sums subscribed and granted for fever hospitals in Ireland at the presenting sessions preparatory to the spring assizes of 1849 was £7,885. The number of fever hospitals supported by the poor-rates in 1848 amounted to 233 under the Temporary Fever Act, the cost of which was £81,448; and to 80 not under that act, the cost of which was £21,789.

TO CORRESPONDENTS.

"Inquirer, Hackney."—We will endeavour to give you the desired information next week. Your first letter must have miscarried.

"Mr. E. Hollies, Dudley."—We have written several times to the inventor of the apparatus requesting a more detailed description and, if possible, an engraving of it; hitherto our applications have proved unsuccessful. In our next number we will supply our correspondent with the best possible description of the apparatus, and the mode of constructing it, which our own limited knowledge of the subject will enable us to give.

"Mr. Miller, Birmingham."—Cinchonia was discovered in 1820 by Pelletier and Caventou in the grey Peruvian bark. This grey bark is supposed to come from the Cinchona nitida or C. condaminea. Probably the celebrated Loxa cinchona contains the same principle. The following process of extraction was had recourse to by Pelletier and Caventou:—4 2-5 lbs. avoirdupois of grey bark in powder were digested in 13½ lbs. of alcohol. This treatment was repeated twenty times. The alcoholic tincture being decanted, the alcohol was distilled off after the addition of 122 cubic inches of water. The residual liquor being filtered left on the filter an apparently resinous matter: this was washed with water containing a little potash, until the liquid passed without colour. The matter remaining on the filter after being well washed with distilled water is greenish-white, fusible, soluble in alcohol, and crystallizable. It is cinchonia. For further information on this subject we refer our correspondent to Soubeiran's lectures.

"P. C. R., Chelsea."—A very convenient kind of charcoal furnace, and much employed by chemists, is made out of a blacklead-pot. Full directions are given in Faraday's Manipulations for converting the pot into a furnace. The plan is as follows:—Cut a number of holes in the side of the pot by means of a knife and ratstail file; then bind the pot with copper or iron wire, and drop in a grate about two thirds of the depth. On an emergency a wire grate may be constructed, but it soon burns away. A blacksmith can easily make a grate of wrought iron—cast iron is still better. Instead of a blacklead-pot a common brown ware flower-pot answers just as well, but is more difficult to cut. It generally cracks after having been used once or twice, but the wire binding prevents the pieces separating.

"Mr. F. C. Tyson, Pimlico."—Sulphuretted hydrogen gas is not a negative but a positive poison, a very small per centage being sufficient to kill, if its breathing be prolonged. The small quantities which escape in a chemical laboratory do not usually produce any vicious effect on the constitution. Dr. Christison, however, remarks that he has frequently suffered from headache due to this cause.

"C. T."—We cannot advise you in the matter.

"W. R."—The process is *not* patented. If you can introduce *essential* and *material* improvements in it, we think you may take out a patent for the improved process.

"B. B."—We have not yet received the communication alluded to by our correspondent.

"Analysis."—Hydrosulphuret of ammonia.

"Mr. Wynn, Hampstead-road."—In proportion as water is pure the more readily does it act as a solvent for lead. Hence this practical deduction may be gleaned—not to use leaden tanks for rain-water, nor for spring-water, which contain but small amounts of foreign bodies. A small pinch of common salt added to rain-water in a leaden tank completely obviates all danger of solution.

The Chemical Times is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary or scientific communications to be addressed to the Editor, 320, Strand.

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ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,

Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXXX.

(LECTURE CXIII.)

VEGETO-ALKALIS—(*Continued*).

SOLANIA—ATROPIA—HYOSCYAMIA—DATURIA—(*Continued*).

The narcotic principle of the divers Solaneæ appears to be one and the same in all these plants. It exerts a peculiar action upon the brain, causing headache, disturbances of the perceptive faculties, giddiness, and fantastical dreams. Administered in strong doses, it produces, besides these symptoms, muscular weakening, torpor, and somnolency; even death may ensue. A remarkable property of these plants is the action which they exercise on the pupil. They dilate this organ strongly, and are on this account employed by surgeons for the purpose of preparing the eye for certain operations.

We possess as yet no very precise knowledge on the nature of the chemical principle to which the narcotic Solaneæ owe their properties. A tolerably large number of observations agree in attributing these properties to the presence of one or several matters bearing considerable analogy to the vegeto-alkalis.

M. Desfosses was the first to arrive at the conclusion that the narcotic Solaneæ contain an organic alkaline base. He called this base *solania*.

The subsequent observations of other chemists rendered it doubtful whether or not some of the Solaneæ contained this or a different organic base. At last, Mein, a German chemist, and Simes, an American, succeeded in obtaining from divers Solaneæ several vegeto-alkalis. The subsequent labours of Geiger, Hesse, and Otto fully confirmed the results arrived at by Mein and Simes.

Solania, atropia, hyoscyamia, and daturia form a group of immediate principles, analogous in their nature and properties to the vegeto-alkalis. Nitrogen forms a constituent of these principles. The properties of these four alkalis are very similar; still they differ sufficiently to prevent their being confounded with each other.

ATROPIA.

Atropia is found in the roots, leaves, and stalks of belladonna. It is a colourless substance, which crystallizes in silky, transparent prisms. It has no smell. It is fusible, and volatilizes at a little above 212° Fahrenheit. It dissolves very readily in absolute alcohol and ether, particularly with the aid of heat. Cold water dissolves about 1-500th part of its volume of atropia; in hot water this alkali is somewhat more readily soluble. The aqueous, ethereal, and alcoholic solutions of atropia restore the blue colour of reddened litmus paper. Atropia combines readily with acids, and forms definite compounds with them. The sulphate and acetate of atropia crystallize readily. The nitrate and hydrochlorate crystallize with greater difficulty.

Infusion of gallnuts forms a copious white precipitate in an aqueous solution of atropia. Solution of chloride of gold produces a yellow, solution of chloride of platinum a yellow-dun, precipitate. The lemon-yellow precipitate formed by chloride of gold in an aqueous solution of atropia becomes gradually crystalline, and constitutes a real compound of atropia and chloride of gold.

Atropia when left for any length of time in contact with water and air, even at the common temperature, suffers a remarkable alteration: the crystals disappear, the liquid acquires a yellow colour, and becomes uncrystallizable. On evaporation it leaves a matter of nauseous odour; this matter is soluble in water, and possesses all the poisonous properties of the original atropia. If this matter be now treated with an acid, and the acid solution obtained with animal charcoal, alkalis will precipitate from it the original atropia with all its primitive properties.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON THE RELATIVE EXPANSIONS OF MIXTURES OF ALCOHOL AND WATER

Under the Influence of a certain Rise of Temperature; and on a New Instrument for Taking the Specific Gravities of the Same.

By G. H. MAKINS, Esq.

About two years since I made some experiments upon an instrument described by the Abbé Vidal, of Toulon, and called by him the "Ebullioscope Alcòométrique."

The instrument was designed for estimating the proportion of alcohol in mixtures containing it, and especially in those wherein specific gravity gave false results, in consequence of saccharine or saline bodies being held in solution, which so increased the specific gravity as often to disguise even large proportions of alcohol.

Before going to the immediate subject of this paper, I may just mention the conclusions to which I came with regard to the instrument in question. Having been put before Mr. Bate (the maker of Sikes's hydrometer to the Excise and Customs) as an instrument likely to supersede the hydrometer, from the fact of its embracing indications which the hydrometer itself could not show, while at the same time the ordinary indications of the latter were readily obtained by it, it became an object to test carefully its effectiveness.

I found, as most persons will anticipate, that the first and greatest objection to the instrument was dependent on the fact of the boiling-point of a liquid being so considerably influenced by the state of the barometer at the time of its examination. For, as the latter is high, so will the point of ebullition be high in proportion, and consequently the specific gravity of the alcohol under examination appear lower than it should do.

We examined, at the time, the difference in the boiling-points, between the barometer points 29.1 and 30.1, in several specimens of alcohol of different degrees of dilution; as examples from these I may mention Excise proof, in which, for the one-inch pressure, there was a difference of 1.4° temperature; and in the case of 70 under-proof (specific gravity 977.2) we found as much as 1.8° for the inch of difference.

A second and great difficulty, especially to persons not much accustomed to chemical manipulation, as, for instance, those using excise instruments, consists in the extreme care required to read off the degree indicated by the ebullioscope, just at the moment of the boiling of the liquid; for, if this be not done precisely at the proper time, evaporation of the spirit speedily takes place, rendering the specific gravity of the mixture very much higher than it was at the commencement of the examination.

The instrument being now constructed under a patent in London has induced the makers to bestow much care upon its construction, and consequently to obviate the former evil by an adjustment upon the scale to be regulated by the height of the barometer.

During the time I was engaged on this subject, Mr. Negretti, who had bestowed much care and thought upon the thermometers for the instrument, suggested that another instrument might be made in which the sources of error would be less, and wherein the simple expansion of the spirit by a certain number of degrees of heat would effect the end of ebullition. From some experiments he showed me I was induced at once to undertake the examination of the subject with him. I had some hesitation as to whether the incomplete results we have already obtained were worth the attention of the society, for I am not yet able, from various causes, to communicate the whole of our experiments, but am induced to bring forward that part of them relating to the expansion of spirits, not containing saccharine matter, from the fact of an article having appeared describing an apparatus for the same purpose, and detailing some results obtained with it, which I do not consider altogether correct; at least, my own conclusions, based on most careful experiments, seem to contradict them. The article I allude to is by Silbermann, and appeared in the "Comptes Rendus" for October 23, 1848; which, by the way, was transcribed into the January number of "The Chemical Gazette."

I will now describe the instrument we employed, as, upon inspection, it may seem a somewhat complicated one to effect an object which might be brought about in a tube similar to the common thermometer tube; indeed, a thermometer bulb and tube on a large scale, furnished with a stopper below for the admission and adjustment of the sample of spirit, would very well answer the purpose. Our instrument consists of a couple of chambers connected by a set of tubes; from the upper chamber rises a tube and scale, the former of as uniform bore as could be procured, and to the lower is attached a small stopcock. The form given to the instrument was adopted in order to afford as large a metallic surface as possible, so as to heat a badly-conducting fluid quickly and uniformly, and its parts were so shaped and put together, that the free exit of any portions of air which might enter with the spirit by the stopcock was ensured. A thermometer was placed in the interior for showing the temperature more correctly of the enclosed spirit.

This last is a point of some importance to the results afforded, and I may instance what I have frequently observed in taking the specific gravity of alcoholic liquids and similar badly conducting fluids, viz., that a thermometer will often indicate a difference of a degree or more in different parts of a thousand-grain bottle, according to the manner in which the bottle has been filled. In using the instrument, our plan was to fill it slowly by gradual depression in a tall vessel containing the specimen for examination. A slight shaking then sufficed to dislodge any air which might have been adherent to the sides of the tubes, &c., after which the zero point was carefully adjusted by means of the stopcock. This having been effected, the temperature of the whole was brought to 60° Fahr. by means of immersion in a large vessel of water at that temperature. It was then quickly plunged into a second vessel containing water at 90° Fahr., and agitated until the thermometer in the instrument indicated this rise of 30° Fahr., when the expansion was carefully noted.

The actual expansions are here, of course, not observed, no allowance being made for that of the instrument itself, which is considerable, and diminishes, by just its amount, that of its contents; all that is here ascertained being the relative dilatation of the several specimens of different specific gravity.

Attention may here be drawn to the difference in the amount of expansion for the same number of degrees increase of temperature when this increase is in different parts of the thermometric scale. And again, that this difference increases as the proportion of alcohol in a mixture is diminished. In the case of proof spirit, for example, I found that between 60° and 90° Fahr. an expansion indicated by a rise of 6.48 inches on the scale was obtained, while between 90° and 120° Fahr. it increased to 6.84 inches.

The most convenient temperature for operating was between 62° and 92° Fahr., and a number of specimens were first very carefully prepared, to agree with the indications of Sikes's hydrometer, or as nearly as possible to these. The spirits

were allowed to stand forty-eight hours after mixing before being subjected to expansion, and the laboratory was kept as nearly as possible at 62° Fahr.

We commenced with the examination of distilled water (the 100 point of Sikes), the water having been previously boiled, so as to expel any air contained in it. The stem and body of the instrument happened to be so proportioned as to give a rise of 1.47 inches for the 30° of difference of temperature; and the time occupied in thoroughly heating the water amounted (generally) to about one minute. As distilled water formed our starting-point of comparison, we repeated the experiment with it several times with every possible care, but uniformly with the same results.

The measurements of the expansions of the samples we examined, each ascending by 10° of Sikes's hydrometer, are given in the table below:—

		Inches.
90	under-proof gave an increase of...	1.72
80	.....	2.10
69.9	.....	2.69
60	.....	3.30
50.1	.....	3.96
39.7	.....	4.69
30.1	.....	5.32
20	.....	5.78
10.7	.....	6.18
Proof	.....	6.48

The experiments upon this last and upon water, as also upon the specimen 70° over-proof, which I shall have to mention, were several times repeated, but the same amount of expansion was uniformly obtained.

Then to pass to over-proof specimens:—

		Inches.
10	over-proof rose to.....	6.72
20.2	.....	6.94
30.2	.....	7.15
40.2	.....	7.43
49.5	.....	7.72
60.4	.....	8.03
70	.....	1.13

We stopped our examination at 70° over-proof. I have here constructed a scale, which, for distinctness, is divided into two parts. In the first (Fig. 1), the assumed expansion of anhydrous alcohol for the 30° of increase of temperature between 62° and 92° is shown. The space is divided into 100 equal parts, each part representing 1 per cent. of alcohol; at the side are placed the expansions of specimens (each descending by 10° of Sikes's) from anhydrous alcohol to water. The zero point has been omitted in the scales, to diminish their length; it should be placed 1.47 inch below the first division, and represents the height to which the stem of the instrument was filled in each case, previous to expansion. Alcohol, of 70° over-proof, consists of about 6 parts water to 94 of alcohol, so that in the construction of the table this expansion of alcohol of 70° over-proof has been divided into 94 equal parts, each division representing 1 volume of alcohol; to these 94, 6 divisions have been added to make up 100, thus completing the range between water and anhydrous alcohol.

The second scale (Fig. 2) is similarly divided into 100 parts; and opposite these divisions, at their proper points as to proportions of alcohol and water, are ranged the several proof points examined, with their specific gravity at 62° Fahr.

On comparing the two tables, a gradual increase will be observed in the rate of expansion from some points, and a decrease from others; and these amounts of increase and decrease do not in any way correspond to the relative quantities of alcohol and water in the mixtures, but are totally independent of them.

Now, from Silbermann's paper you might be led to a very different conclusion, viz., to this—that the expansion takes place at a uniform rate of increase, corresponding to the increasing proportions of alcohol, for he says, "If a series of mixtures of alcohol and water be made, beginning with water 100 parts, alcohol 0; water 99, alcohol

Fig. 1.

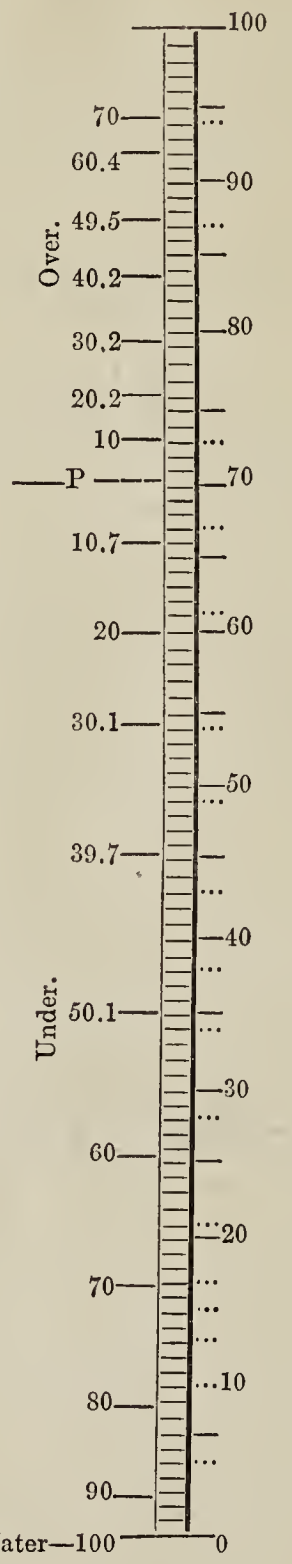
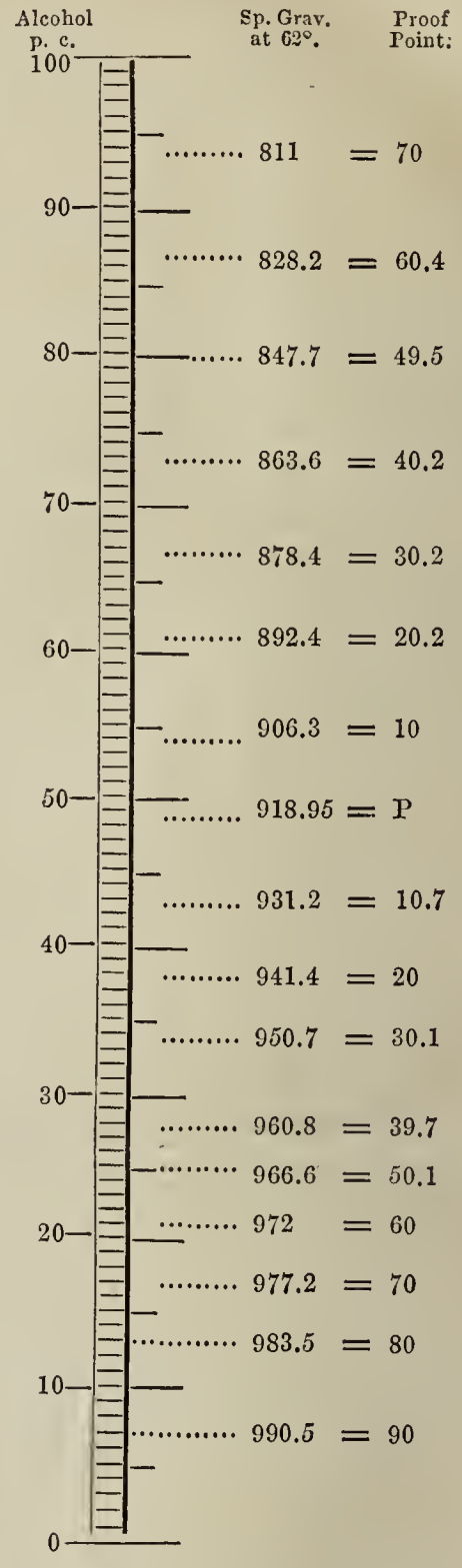


Fig. 2.



1; water 98, alcohol 2; water 97, alcohol 3, &c.; up to water 0, alcohol 100; and their several points of elevation at the respective temperatures of 25° and 50° (Cent.) be carefully marked on the tube, a complete centesimal alcoholometric scale will be produced, which will indicate the quantity of alcohol contained in any mixture of alcohol and water by introducing it at 25°, and afterwards heating it up to 50°."

If the measurements I have given are compared, it will be found that they are in an increasing ratio up to 40 under-proof (which contains about 28 alcohol+72 water); they then decrease somewhat rapidly to 30 over-proof. A third change then takes place, and they again increase to 60 over-proof. And lastly they again decrease very rapidly to 70 over-proof; and possibly to anhydrous alcohol, though, from the various sources of error in observations on very strong alcohol, we did not use it above 70 over-proof; that is to say, of a specific gravity of 0.811 at 62°.

Now, if all this be true, and I may state that every possible precaution was observed to ensure the accuracy of the experiments, it becomes a question to determine why these expansions do not take place just in the proportion of the alcohol contained in the respective mixtures, or, in other words, why certain regular variations in the rate of expansion take place about certain points in the scale. I believe the answer may be satisfactorily given in a few words; namely, that the expansions depend on the existence of certain definite hydrates of alcohol, which hydrates are formed somewhere near the proportions at which these changes occur.

In conclusion I must repeat, that the experiments I have described were undertaken some two years since, and, having been prevented carrying them fully out at the time, I did not intend to bring them before the society until they had been brought into a much more definite form, by repeating them on mixtures containing alcohol in regularly increasing proportions; but the appearance of the paper I have mentioned compels me to put them, incomplete as they are, into the form of a notice, hoping, as I do, to work the subject fully out, and, having done so, to bring it again before the members.

I may mention that the instrument we have used (or a more simple modification of it) affords a very ready and accurate means for the determination of the specific gravity of such mixtures, and is, I believe, much more likely to be useful than the common glass hydrometer now so much employed for the purpose.

The sensibility may, of course, be augmented by increasing the proportion of the chamber as compared with the tube, always taking care not to have the latter so small as to be influenced to any great extent by capillary action; again, by using a greater range or higher temperature; and lastly, by making the chamber of such form and material as shall yield but little to expansion, and consequently exert a lesser influence upon the expansion of the liquid contained in it.

Mr. Negretti is now making the instrument in a simple and inexpensive shape for such purposes. —*Journal of the Chemical Society.*

ON MEDICINAL WINES.

By BUTLER LANE, M.D.

[From the *Pharmaceutical Journal.*]

In the June number of the *Pharmaceutical Journal* I briefly adverted to the appliance of fermentation for the purposes of pharmacy, and I now intend entering more fully into the consideration of the subject, with the hope of inducing some of those who make pharmacy the special province of their study to bestow that observation and research in the inquiry which is, I believe, deserved, at the same time that it would be amply repaid.

In this age of onward movement, pharmaceutics, in common with the other branches of medicine, have undergone great improvement. No longer a mere mechanical occupation, the art of pharmacy now welcomes the enlightenment of science, and promises to keep pace with the intellectual advance of the day. The important change which is now progressing cannot fail to raise the position of the pharmaceutic practitioner, at the same time that it is hailed with warm satisfaction by the unprejudiced surgeon and physician, as tending to improve the resources of medical science at the same time that it affords confidence in our remedial appliances in lieu of that distrust which formerly almost invariably attended the ministrations of the "chemist and druggist." All honour to those who have been instrumental in originating and promoting this change by the establishment of the Pharmaceutical Society! May they continue to succeed in their endeavours, and may each individual pharmaceutist consider it as part of his social duty to assist in promoting the object of the present organization!

I cannot refrain from thus adverting to the Pharmaceutical Society, and I feel much pleasure in submitting the present matter of my inquiry to the tribunal of their judgment, as in a great measure it more particularly belongs to their special department of medical art.

In former times the cerevesiæ, or medicinal beers, were in great repute, and I now find that they were much more extensively employed than I had any idea of. These cerevesiæ were prepared by adding medicinal substances in powder to malt wort, and letting them ferment together. There were no less than thirty cerevesiæ in Quincey's "Dispensatory" of 1739, but towards the end of the eighteenth century they fell into total disuse. In Lewis's "Dispensatory" of 1785, however, there is a strong argument in favour of fermented preparations, and it is there asserted that the properties of drugs are extracted with much more energy by fermentation than by simple digestion. In the present day I believe that the agency of fermentation is still tacitly adopted to a considerable extent, especially in preparations of opium and sarsaparilla. Thus, therefore, I do not claim much merit of originality in recommending fermentation as a method of medicinal preparation; but it may be said in excuse for the revival of an old process that it certainly seems probable, in these days of chemical improvement, that the principle may now be carried out much more effectively than formerly. If, therefore, I can but show sufficient evidence in favour of the process on the score of economy and medicinal efficacy my views will claim scrutiny and trial; and I do not doubt that tact and experience may carry the matter to a great degree of perfection.

We are indebted to the botanical kingdom for a large proportion of medicinal remedies, and their best adaptation to practical purposes is highly important. Chemistry has done much in the recognition and isolation of peculiar active principles; but in many instances the gross extract of active medicinal matter from that which is inert is preferred for therapeutical purposes by practical men; and, again, the expensive nature of the chemical processes requisite for the obtainment of the various alkaloids, &c., constitute an objection, especially if preparations more economical and equally efficient can be made available.

In the application of the process of fermentation it is, of course, requisite to select those medicinal substances of which the active principles are in a great measure capable of aqueous solution, and I shall presently advert individually to those in the preparation of which I have had experience. From some drugs the entire of the medicinal essence may be thus obtained, constituting a perfect extract; of others only a certain portion of the active matter will be separated and made available; but that may be the leading principle and in its most efficient form, inasmuch as it will be that which will be most readily recognised and assimilated by the human economy.

The aqueous solution of the medicinal principle must be effected according to the method best adapted to each individual instance. Various degrees of temperature should be employed in infusing and digesting the medicinal material. In many instances it will be found that it is requisite to use a high degree of temperature, and that it should be applied continuously for some time. In others, tepid or cold infusion, or digestion, is preferable; and frequently one part of the aqueous menstruum may be used cold, and the other in a heated state.

The aqueous extract should be submitted to fermentation in a varied state, according to special circumstances. Thus, in reference to opium, its entire substance should undergo chemical action, separating merely the ligneous and earthy matter of the crude extract; and, on the other hand, in treating hyoscyamus, digitalis, &c., though mucilaginous matter is extracted in the first instance, yet it should all be separated before fermentation is allowed to commence. Again, a considerable degree of concentration may sometimes be effected in fermented preparations, in some much more than in others.

Sugar or alcohol, singly, or both combined, in the aqueous solution of any appropriate vegetable substance, will be efficient in its preservation. Now, sugar may readily be made the medium of the formation of alcohol to a considerable extent by exciting fermentative action after the sugar has been dissolved in the medicinal solution; and I believe that, in the great majority of instances, the change may be effected without prejudice to the active medicinal principle; while the alcohol which is generated assumes that state of intimate vinous combination which is very preferable to the comparatively raw state in which it exists in tinctures. The perfect conversion of three pounds of sugar would afford about a pound and a half of rectified spirit; but in the ordinary course of vinous fermentation that perfect conversion does not take place, but it is usually effected to a sufficient extent for the preservation of seven wine pints of medicinal solution when combined therewith. The proportion of sugar must, however, be varied in different cases, and if a sweet preparation be desirable, or its preservation for a lengthened period be required, then a larger quantity of sugar must often be used. Thus the minimum proportion of sugar in one gallon of medicated wine must be three pounds avoirdupois—not three pounds of sugar added to a gallon of the liquor, but the sugar must form an integral part of the gallon, and will occupy about one half part in eight. It is of consequence that the due proportion of sugar should be used to avoid the liability to acetous action; and good loaf-sugar ought always to be employed, as the fermentation then goes on more thoroughly, and the wine is more readily obtained fine and clear.

I may here remark that a small proportion of free acid is always present in the medicinal wines; but, far from being really an objection, I believe it helps to keep the active principle in a natural state of solution, and when administered presents it to the stomach in the state most grateful and readily assimilated. All who have tried the wines, whether tonic, sedative, or aperient, have noticed how remarkably well they have agreed with the stomach when given simply by themselves without any adjuvant or corrigent additions.

The saccharine solution being duly prepared, yeast must then be added, and the wash be placed to ferment in jars or casks, at first open, and subsequently lightly closed. To effect the fermenting process quickly an equable temperature between 70° and 80° should be maintained; but I believe the process will take place more perfectly, though more slowly, at a temperature between 55° and 65°. If the higher temperature be employed, it should at any rate be reduced after a fortnight, and, as soon as the violence of the fermentation subsides, the atmospheric air should be more perfectly excluded. After a further variable period the sweetness will be found to have gone off considerably, the liquor to have become fine, and the fermentative action to have ceased in a great measure; it should then be carefully decanted from the lees by syphon or otherwise into fresh vessels, which are to be carefully closed. If, from undue exposure to air, or any other cause, the fermentative action does not subside when judged to have proceeded sufficiently, it must be arrested by the addition of a little oxide of manganese, sulphuret of potash, or even a small proportion of spirits of wine, and, while yet fermenting, it must be kept in bulk, and, on no account, bottled.

It is a great object to know when, the fermenting process having gone on to a sufficient extent, it becomes desirable to check its further progress, and prevent its beginning afresh. To seize the proper moment of time requires time and judgment; and the state of the wine as to taste and appearance, I believe, will alone afford the criterion. Acting on the suggestion of Dr. Golding Bird, I endeavoured, with the aid of the hydrometer, to ascertain the progressive formation of alcohol; but I found the variations of specific gravity so irregular, according to the peculiarity of the substance in solution, from the fermentative disturbance, that I could obtain no satisfactory results. Generally, an increase of specific gravity would be apparent at first, and finally a decrease of from five to fifty per mil. would occur. If, however, the wines be well and thoroughly fermented in the manner which I have pointed out, I believe there will generally be but little difficulty in obtaining them fine and in good condition. Before bottling they require some exposure to the air, and occasionally fining with isinglass will be found necessary. In my experience I have found that the different medicinal wines may be got ready for use within a period of three months; and, when bottled, they will keep any length of time.

[*To be continued.*]

ON THE PREVENTION OF SMUT IN WHEAT.

By M. GIRARDIN,

Professor of Chemistry at Rouen.

A commission was appointed at Rouen in December, 1842, having for its object to determine the best process of preventing the smut in wheat, and to ascertain whether other means less dangerous than arsenic and sulphate of copper (both of which are extensively employed in Great Britain) were productive of equally good results. The labours of this commission extended over the years 1843, 1844, and 1845, and the experiments were repeated two years

following, on the farm of M. Fauchet, one of the commissioners, at Boisguillaume, in the department of the Seine Inferieure. M. Girardin, professor of chemistry at Rouen, and corresponding member of the Institute, took a very active part as a member of the commission, and drew up the following valuable report on the subject:—

As long ago as the year 1779, M. Duhamel du Monceau, in his "Elements of Agriculture," noticed the employment of arsenic by the farmers of France for the prevention of smut, and, whilst speaking of the dangers arising from the use of arsenic for this purpose, expressly points out the dangers arising from the partridges, pigeons, &c., eating the poisoned seeds, and thus endangering the lives of those who used them for food. It would appear that in the ten years from 1830 to 1840 there had occurred in France 235 public accusations of poisoning, out of which number 110 were against individuals connected with agricultural pursuits, and it was considered that this arose from the readiness with which they were enabled to obtain poisons, especially arsenic, for the purpose of steeping grain. The wheat selected for the purpose of trial was the red Scotch wheat, of the harvests of 1843 and 1844, thoroughly sound, and not in the slightest degree tainted with smut. A quantity of smut was then procured, with which the good wheat was completely saturated, in such a manner that the particles of smut attached themselves to the healthy grains of wheat and communicated the disease to them. A piece of ground was selected from which had previously been taken a crop of potatoes, and divided out into 13 parcels or lots, of 10 square metres each. The piece of ground was level, of the same nature through its whole extent. Each parcel was separated from its neighbour by a strip of ground, which was kept uncultivated whilst the experiments were in progress. They were each sown early in November, in favourable weather, with the same quantity of grain, viz., three decilitres.

No. of Parcel.	Nature of the Wheat and Mode of Steeping Employed.
1.	Wheat gathered before arriving at maturity, whilst the perisperm of the grain was still in a milky state.
2.	Unripe wheat, gathered when the perisperm was solidified, but when the epidermis was still green.
3.	Wheat gathered when the grain and the ear were yellow; but when the grain might still be cut with the nail.
4.	Wheat gathered when the grains had acquired their hardness and transparency.
5.	Perfectly ripe wheat, not smutty, nor having received any preparation.
6.	Ripe wheat, smutty, but without any preparation.
7.	Smutty wheat, washed previously to sowing with double its volume of pure water.
8.	Smutty wheat, plunged for two hours in a solution of sulphate of copper and salt.
9.	Smutty wheat, prepared with sulphate of copper alone.
10.	Smutty wheat, prepared with arsenic.
11.	Smutty wheat, prepared with recently slacked lime.
12.	Smutty wheat, prepared with lime and salt.
13.	Smutty wheat, prepared with sulphate of soda and lime.

At the end of April the wheats, of which the germination and growth up to that time presented no appreciable difference, appeared as follows:—

1. Tolerable, but a little deficient at the right side of the lot.
2. Tolerable; a little less deficient on the same side.
3. Pretty good.
4. Pretty good, but a little less clean than No. 3.
5, 6, 7. Good.
8. Indifferent, clean, but somewhat irregular.
9. A trifle better than No. 8,
10, 11, 12, 13. Good.

At the end of September the wheats were ripe. The reaping was accomplished with the greatest ease; the product of each lot was put separately, and immediately received the number of its order. At the end of October the weight of the sheaves was taken, and the ears cut off with scissors; the smutty ears were separated from the sound, and an account taken of each. The healthy ears of each lot were then thrashed in a close sack, so that not a grain might be lost. The wheat thrashed and winnowed was then measured and weighed, and each lot was placed in a separate vessel. The weight of the sound grain and the weight of the smutty ears deducted from the weight of each sheaf gave the absolute weight of the straw.

The following table contains the information relative to the products of the different lots:—

Number of the Wheat.	Weight of the Sheaf.	Number of Sound Ears.	Number of Smutty Ears.	Volume of Good Grain.	Weight of Good Grain.	Weight of Smutty Ears.	Absolute Weight of Straw.
	Kil.			Litres.	Kil.	Grms.	Kil.
1	8.250	..	..	2.32	1.735	..	6.515
2	7.100	..	..	2.33	1.744	..	5.356
3	7.250	..	..	2.35	1.768	..	5.482
4	6.750	..	..	2.27	1.720	..	5.030
5	8.000	..	..	3.00	2.363	...	6.637
6	7.250	1.463	1.004	1.96	1.569	460.0	5.221
7	8.000	2.509	192	3.30	2.416	87.5	5.496
8	7.250	2.187	19	2.95	2.221	8.8	5.020
9	8.250	2.201	46	3.15	2.400	21.0	5.829
10	8.000	1.926	125	2.17	1.676	57.4	6.267
11	8.500	1.971	250	2.70	2.101	114.7	6.284
12	8.250	2.042	114	2.50	1.928	52.2	6.270
13	8.000	2.431	60	2.87	2.258	27.5	5.714

A kilogramme is equal to 2 lbs. $3\frac{3}{4}$ oz. avoirdupois; a litre is equal to $1\frac{3}{4}$ pint imperial.

This table clearly shows the effects of the different modes of treatment of smutty wheat, as well as the influence of the various stages of maturity in the wheat on the development of the smut. Observe that Nos. 1, 2, 3, and 4, taken at different periods of maturity, present no trace of smut. Two following years the same results were obtained. If we take the per centage, as in the following table, of the number of smutty ears for each of the last eight lots, we shall better appreciate the influence of this kind of treatment:—

No. of the wheat.	No. of smutty ears per cent.
1, 2, 3, 4	—
5	0.00
6	40.69
7	7.80
8	0.86
9	2.04
10	6.09
11	11.25
12	5.28
13	2.40

The different modes of treatment may be arranged in the following order to show the respective efficaciousness of each:—

No. 8. Sulphate of copper and salt.
" 9. Sulphate of copper alone.
" 13. Sulphate of soda and lime.
" 12. Lime and salt.
" 10. Arsenic.
" 7. Washing with pure water.
" 11. Lime alone.

Thus our experiments permit us to conclude with assurance—

1st. That sulphate of copper is one of the most powerful means of preservation from smut.

2dly. That lime produces but very little effect, and its use is even less advantageous than simple washing of the seed in water.

3dly. That common salt exerts a very marked influence, as the substances with which it is associated acquire a more decided beneficial action than that which they possessed alone; for instance, lime then becomes very efficacious, and sulphate of copper produces better results than when employed singly.

4thly. That arsenic does not possess anything like the destructive action on the smut which is generally supposed.

5thly. That the mode of steeping the grain in a preparation of sulphate of soda and lime is really very efficacious.

Our experiments are both valuable and satisfactory, especially as their results have been uniform, and have also coincided with those formerly made by agriculturists and other careful observers in different localities. Thus, wherever sulphate of soda has been employed, the wheat has always been entirely free from smut. Six years ago M. Fauchet adopted this plan with great success; nowhere have we seen finer or healthier crops of wheat than he reaps every year. In many of the departments the use of lime is abandoned, from its inadequacy for the required purpose. One of our most distinguished agriculturists, M. A. Baudouin, President of the Agricultural Committee of Povilly, is quite satisfied with sulphate of copper, to which he has given the preference. It is the same case with the agriculturists of Marne, Haute-Marne, the Tarne, the Lot and Garonne, and the Lot; but this salt is a poison no less dangerous than arsenic, and on this account we should discontinue its use. It is curious as well as useful to ascertain if the different plans of steeping the wheat exert an influence on the produce both of grain and straw. To obtain these particulars, we took carefully the account of the volume and weight of the grain, and the absolute weight of the straw. To render these differences the more apparent, we have transferred the figures in one of our preceding tables into hectolitres and kilogrammes. It will thus be more easy to compare the produce of our cultivation with that usually obtained from each hectolitre (equal to 22 imperial gallons) of grain sown.

No. of Wheat.	Produce in Hectolitres by Hectolitre of Seed.	Produce in Kilogrammes by Hectolitre of Seed.	Weight of a Litre of good Grain.	Absolute Weight of Straw by Hectolitre of Seed.
	Hecto.	Kilo.	Kilo.	Kilo.
1	7.73	578.333	0.747.8	2171.666
2	7.76	581.333	0.748.5	1785.333
3	7.83	589.333	0.752.3	1827.333
4	7.56	573.333	0.757.7	1676.666
5	10.00	787.666	0.787.6	1879.000
6	6.53	523.000	0.800.5	1740.333
7	11.00	805.333	0.732.1	1832.000
8	9.83	740.333	0.752.8	1673.333
9	10.50	800.000	0.761.9	1943.000
10	7.23	558.666	0.772.3	2089.000
11	9.00	700.333	0.778.1	2094.666
12	8.38	642.000	0.771.2	2090.000
13	9.56	752.666	0.786.7	1904.666

The principal conclusions to be drawn from these tables are the following:—

1st. That in all respects it is advantageous to employ only sound wheat for seed.

2dly. That the wheats least productive of grain were those which were steeped in arsenic, lime, and salt, and lime alone.

3dly. That the wheats most productive of grain were those which were washed in water, treated with sulphate of copper, sulphate of copper and salt, sulphate of soda and lime.

4thly. If the washing with water was favourable to the production of grain, its weight is remarkably diminished.

5thly. The heaviest weight of the same bulk or volume is that which has not received any preparation, and next to that the wheat treated with sulphate of soda.

Since amongst all the various parcels of wheat reaped there were found, as may be seen, a certain number of smutty ears, it appears that there is, in reality, no specific nor radical and infallible remedy for this disease; but it ought to be remarked that, to render our experiments more conclusive, we saturated the wheat with smut. In practice, however, this is never the case; grain is never sown in the state of that which we made use of. It is no doubt to this circum-

stance we must attribute the fact of having found some black ears amongst the wheat treated with sulphate of copper and sulphate of soda, which we look upon as the most active and sure remedies for smut. One thing is certain, that our fellow-labourer in these researches, M. Fauchet, has for many years made use of Glauber's salts, and no longer knows what it is to have smut. This salt, then, associated with lime, we must look upon as an infallible remedy.

En resumé, the commission is of opinion :—

1st. That it is best not to sow seed without steeping.

2dly. That it is best to make use of the sulphate of soda and lime process, inasmuch as it is more simple and economical, and in no way injurious to the health of the sowers, or inimical to the public health; and that it yields the most productive and soundest wheat.

3dly. That as arsenic, sulphate of copper, verdigris, and other poisonous preparations can be advantageously replaced by sulphate of soda and lime, the use of the poisonous preparation should be interdicted by the Government.

INVESTIGATIONS ON THE NATURE OF THE MINERAL SUBSTANCES NECESSARY FOR THE DEVELOPMENT OF A VEGETABLE.*

By the PRINCE OF SALM HORSTMAR.

The Prince communicates the result of some interesting investigations which he undertook concerning the inorganic substances which were necessary for the development of a plant.

To determine these mineral substances with accuracy, the first condition necessary to be fulfilled was to find a medium which was perfectly free from inorganic matters in which seeds might be made to germinate. The author fixed on the charcoal arising from the calcination of the purest and whitest sugar-candy. This charcoal had been prepared on a porcelain plate, placed in the muffle of a reverberatory furnace, which was safe from the introduction of cinders. The product was powdered and calcined a second time before being used, in order to destroy all traces of carburets of hydrogen, which are prejudicial to vegetation. The author used oats in all his experiments, and this selection was made on account of the importance of the plants belonging to the family of Gramina, and of the fact that, even in a room, the oat gives ears capable of ripening.

The experiments were made in tin vessels, of $5\frac{1}{2}$ inches high, $2\frac{1}{8}$ inches broad at the top, and $\frac{5}{8}$ at the bottom. These vessels were covered on the inside with white wax, to preserve the roots from contact with the metal. Into each of these vessels was introduced 75 grammes of sugar charcoal, with which were mixed the mineral matters whose influence on vegetation it was desired to study. In order to mix uniformly the small quantities of insoluble mineral matters with the charcoal, they were first triturated with a little charcoal, and then this mixture was added to the rest of the charcoal, stirring the whole in a capsule. The soluble substances were dissolved in 20 grammes of water, and the charcoal was impregnated with this solution. When 0.1 gramme of nitrate of ammonia was employed as a manure, 15 grammes of water were added, because the utility of this excess of water had been demonstrated by previous experiments. When no substance soluble in water was added to the charcoal, it was moistened with 20 grammes of water, after having introduced the insoluble substances. The seed was planted in the charcoal, prepared as we have just described, after having undergone the commencement of germination in perfectly pure charcoal.

The plants were watered with distilled water, and placed in the window of a room exposed to the sun, and of a southern aspect.

The mineral substances were, moreover, prepared with much care; their purity was previously tested. The silicates of potassa and soda were prepared by dissolving with heat uncalcined silica in a concentrated alkaline ley. Phosphate of lime was obtained by double decomposition with nitrate of lime and phosphate of ammonia. The oxide of iron was obtained by precipitating the nitrate of sesquioxide of iron by succinate of ammonia, and calcining the precipitate so as to obtain a mixture of sesquioxide and protoxide.

We now briefly give the results of the experiments undertaken by the author :—

1. No mineral substances, and no nitrogenous matters; plant extremely slight, weighing only 0.05 gramme after desiccation.

2. No mineral substances; the charcoal was moistened with a solution of 0.04 gramme of carbonate of ammonia in 20 grammes of water; the same solution was employed for watering the vegetable during the experiment. Plant very slight. Leaves green and longer than in the foregoing experiment. The stem, $7\frac{1}{2}$ inches high, bore a flower which did not fructify. The dried plant weighed 0.05 gramme.

3. No mineral substances; the charcoal was moistened with a solution of 0.1 gramme of carbonate of ammonia in 20 grammes of water. The plant died after shooting the first leaf. The solution of carbonate of ammonia was too concentrated.

4. No mineral substances; the charcoal was wetted with 20 grammes of water; then watered with a solution of 0.1 gramme of nitrate of ammonia in 20 grammes of water; 15 grammes of water were also added. The plant died after having put forth the second leaf. The roots were very short, and all turned towards the surface of the charcoal.

5. No ammoniacal matters. The following mineral matters were added to the charcoal :—

	Gramme.
Silica, Potassa } Silicate of potassa	0.075, 0.030
Carbonate of lime	0.050
Phosphate of lime	0.040
Sulphate of lime	0.030
Carbonate of magnesia	0.020
Oxide of iron, containing manganese	0.020

The stalk, regularly formed, attained the length of eleven inches without any lateral stalks; the plant was very delicate, and bore three flowers, which aborted; the leaves were short, but green. The plant dried weighed 0.1 gramme.

6. Mineral substances and ammoniacal salts in the following proportions :—

	Gramme.
Silica, Potassa } Silicate of potassa	0.075, 0.030
Carbonate of lime	0.500
Carbonate of magnesia	0.050
Phosphate of lime	0.100
Sulphate of lime	0.100
Nitrate of ammonia	0.050
Nitrate of lime	0.030

The stem, feeble and disposed to bend, grew to twenty-five inches, and bore five flowers, and five incomplete fruits. The joints were covered with sheaths.

The leaves were delicate and of a greenish yellow. The dried plant weighed 0.37 gramme.

7. No silica; mixture in the following proportions :—

	Gramme.
Nitrate of potassa, dissolved in 20 grammes of water	0 014
Carbonate of lime	0.500
Carbonate of magnesia	0.250
Phosphate of lime	0.100
Sulphate of lime	0.100
Nitrate of ammonia, Nitrate of lime } Dissolved in 20 grammes of water	0.030, 0.030

In this experiment less carbonate of ammonia was used, in order to compensate by this diminution for the quantity of nitrogen contained in the nitre.

The plant grew to nine inches; it laid down, was very weak, and of a pale yellow colour; the joints were enveloped by the sheaths of the leaves. A single flower was developed, which did not fructify. The dried plant weighed 0.37 gramme.

8. No potassa: mixture in the following proportions :—

	Gramme.
Hydrate of silica	1.0
Carbonate of lime	0.5
Carbonate of magnesia	0.05
Phosphate of lime	0.1
Sulphate of lime	0 1
Nitrate of ammonia, Nitrate of lime } Dissolved in 20 grammes of water	0.05, 0.05

The plant died before the development of the second leaf; a second seed was planted. It was developed in a very feeble manner, and without bearing flowers; it attained the length of only $2\frac{1}{2}$ inches; its roots were long and extremely thin.

9. No potassa; mineral matters in the following proportions :—

	Gramme.
Silica in jelly, suspended in 20 grammes of water	0.58
Carbonate of lime	0.50
Carbonate of magnesia	0.02
Phosphate of lime	0.04
Sulphate of lime	0.02
Nitrate of lime, dissolved in 20 grammes of water	0.03

Plant six inches long, very delicate, without flowers; roots long and thin.

10. No lime; mixture in the following proportions :—

	Gramme.
Silica, Potassa } Silicate of potassa, dissolved in 20 grammes of water	0.078, 0.030
Carbonate of magnesia	0.070
Ammoniaco-magnesian phosphate	0.080
Nitrate of lime, Nitrate of ammonia } Dissolved in 20 grms. of water	0.020, 0.040

The plant died before the development of the second leaf. The roots were half an inch long, and turned upwards.

11. 0.5 gramme of carbonate of lime was added to the foregoing mixture, to see if the rapid perishing of the plant should be attributed to the absence of lime. In this new mixture the plant vegetated very well, as in experiment 6, although the colour of the leaves was still very pale. Lime is, therefore, indispensable to the development of the plant.

12. No magnesia.

	Gramme.
Silica, Potassa } Silicate of potassa in 20 grammes of water.	0.075, 0.030
Carbonate of lime	0.500
Phosphate of lime	0.100
Sulphate of lime	0.100
Nitrate of ammonia, Nitrate of lime } In 20 grms. of water.	0.050, 0.030

The plant attained the length of 13 inches, with a tendency to lie down; the first three leaves were very green, the following ones of a pale yellow. The dried plant weighed 0.32 gramme.

13. No phosphoric acid: the mineral matters as in No. 6, only suppressing the phosphate of lime.

The plant attained the length of 16 inches; the leaves were of a deep green, but short and narrow; the stalk delicate but regular.

Three flowers and a complete fruit; no lateral stalks; the dried plant weighed 0.17 gramme.

The phosphoric acid contained in the seed appears to have replaced that which the soil could not furnish; only the development of the plant suffered in consequence.

14. No sulphuric acid: the matters as in experiment 6, suppressing the sulphate of lime.

Plant 11 inches long: leaves of a deep green, but short and narrow, and not so well developed as in the preceding experiment.

Stalk normal, two flowers, no fruit; weight of the dried plant 0.12 gramme.

"Journal für Praktische Chemie," xlvi., 193.

The sulphur contained in the seed was not sufficient for the development of the plant.

15. Without sulphuric or phosphoric acid; mineral matters as in experiment 6, without phosphate and sulphate of lime, and with a supplement of 0.05 of nitrate of ammonia. Plant 16 inches long, leaves of a deep green, stem regular, one lateral stem, two flowers without fruits.

16. Silica, potassa, and ammonia, in the following proportions:—

Silica..	Silicate of potassa, dissolved in 20 grammes of water	0.075
Potassa		0.030
Nitrate of ammonia, dissolved in 20 grammes of water		0.080

The plant died during the development of the second leaf.

17. Hydrochlorate of ammonia, 0.02 gramme; nitrate of ammonia, 0.04; the rest of the matters as in experiment 6.

Plant 9 inches long; weak; three flowers, without fruits; weight of the dried plant 0.24 gramme.

18. Neither lime nor magnesia, the rest of the matters in the following proportions:—

		Gramme.
Silica	Silicate of potassa in 20 grammes of water	0.075
Potassa		0.030
Phosphate of lime		0.040
Sulphate of lime		0.030
Nitrate of ammonia in 20 grammes of water		0.010

Plant 15 inches long; leaves pale; stem abnormal and weak.

Four flowers without fruit; weight of the dried plant 0.21 gr. This experiment proves that the plant may flower without any magnesia in the soil, and that carbonate of lime may be replaced by other salts of lime.

19. Potassa and soda.

		Gramme.
Silica.	Alkaline silicate in 20 grs. of water	0.075
Potassa..		0.020
Soda		0.010
Carbonate of lime		0.050
Phosphate of lime		0.040
Sulphate of lime		0.030
Carbonate of magnesia		0.020
Nitrate of ammonia in 20 grms. of water		0.100

Plant seven inches long; leaves pale and of a greenish yellow; stem abnormal; weight of the dried plant 0.1.

20. Oxide of iron.

		Gramme.
Silica	Silicate of potass in 20 grammes of water	0.075
Potassa		0.030
Carbonate of lime		0.050
Phosphate of lime		0.040
Sulphate of lime		0.030
Carbonate of magnesia		0.020
Black oxide of iron		0.100
Nitrate of ammonia in 20 grammes of water		0.100

The addition of oxide of iron caused a very active vegetation. The leaves of the plant were much more vigorous than in any of the foregoing experiments; they were twelve inches long, half an inch broad, rough, and of a deep green; only, after the development of the fourth leaf, dry spots of a greenish-grey colour were remarked in the middle of all the leaves.

Stem abnormal; joints covered with sheaths; plant 13 inches long; no flowers, but several lateral stalks. Weight of the dried plant 0.4 gr. The proportion of iron was evidently too great.

21. Less iron.

Mineral matters in the same proportion as in the foregoing experiment, with the exception that only 0.010 gramme of oxide of iron was added. The plant was developed in a remarkable manner. Leaves green without dry spots; stem normal, and 24 inches long; joints rather weak; five flowers, but no fruits. Weight of the dry plant 0.49 gr.

22. Soda and iron.

Mixed in the same proportion as in experiment 20, only one third of the alkali was soda. Plant very tender; leaves green, with dry spots; no flowers.

23. Iron and manganese.

Mixed in the same proportion as in experiment 20, with the addition of 0.01 gr. of the carbonate of manganese.

Plant vigorous; leaves of a deep green, without dried spots. Joints stronger that in experiment 21, but partially enveloped in sheaths. The sheath of the last leaf was turned round spirally, an irregularity which appears to have arisen from an excess of manganese.

Length of the principal stem 14 inches; several lateral stalks; no flowers. Weight of the dried plant 1.09.

24. Iron and manganese.

		Grmme.
Silica	Silicate of potash in 20 grammes of water	0.115
Potassa		0.046
Carbonate of lime		0.500
Phosphate of lime		0.100
Sulphate of lime		0.030
Carbonate of magnesia		0.050
Oxide of iron		0.030
Carbonate of manganese		0.010
Nitrate of ammonia in 20 grammes of water		0.100

Plants extremely vigorous; leaves of a deep green; no dry spots; sheath of the last leaf less twisted than in the preceding experiment; last leaves of the lateral stalks normal.

Principal stem 26 inches long; joints strong and free from sheaths. Fifteen flowers, without fruit; weight of the dried plant 1.29 gramme.

25. Manganese without iron.

Mixed in the proportion of experiment 20 without oxide of iron. Plant not very vigorous; leaves without spots, but pale; stem abnormal, 12 inches long; two tender flowers, without fruit; weight of the dried plant 0.57 gramme.

26. Iron and manganese, without magnesia. Mixed as in the foregoing experiment: 0.1 gramme of oxide of iron was added. Stem and leaves less vigorous than in experiment 23; leaves of a deep green, without stains; stem abnormal. Length of the plant 9 inches; no flower; one weak lateral stem. Weight of the dried plant 0.36 gramme.

27. Iron, manganese, and soda, without potassa. In the foregoing mixture 0.030 gramme of soda was substituted for the same quantity of potassa. Length of the stem 15 inches; no flower; plant more tender than in experiment 23; the joints enveloped by sheaths. Leaves of a deep green, without stains; the last leaf was turned round several times on itself. Some weak lateral stalks were formed. Weight of the dried plant 0.57 gramme.

28. The same mixture as in experiment 23; only the carbonate of manganese was not added until after the development of the fourth leaf, when stains began to appear. After this addition of carbonate of manganese the succeeding leaves were developed in a perfect manner; the stains were no longer exhibited, a result evidently due to the influence of manganese.

In this experiment the stem, which was very tender, attained the length of 14 inches; it bore three flowers, but no fruit. The leaves were of a deep green; the sheath of the last leaf was not twisted. The author attributes this result to the limited action of the salt of manganese, which was applied only on the surface. The contrary effect, that is to say the twisting of the leaf, is produced by an excess of manganese.

29. Iron, manganese, potassa, and soda, mixed in the following proportions:—

		Gramme.
Silica	Alkaline silicate in 20 grammes of water	0.10
Potassa		0.03
Soda..		0.01
Carbonate of lime		0.50
Phosphate of lime		0.04
Sulphate of lime		0.10
Carbonate of magnesia		0.04
Oxide of iron		0.03
Carbonate of manganese		0.01
Nitrate of ammonia in 20 grammes of water		0.10

Leaves, stem, and joints, very vigorous and normally developed. The leaves were of a deep green; the sheath of the last leaf was not at all twisted. The cause of this vigorous development may be attributed either to the proportions of the mixtures, somewhat modified, or to the simultaneous presence of potassa and soda. The author will endeavour to solve this question by new experiments.

In this last experiment the plant attained the length of 29 inches; it bore fourteen flowers, without fruit; its lateral stems were formed. The weight of the dried plant was 1.46 gr.

The author, after having described his experiments, gives a series of conclusions, of which we subjoin a summary of the most important.

From the first experiments it results that, for a plant to be developed, it must find in the soil at once nitrogenous matters and certain mineral substances. If these mineral matters consist only of silica, phosphoric and sulphuric acids, combined with potassa, lime, and magnesia, the plant vegetates more actively than it would do in a soil entirely free from mineral matters; however, the vegetation is very feeble, even in presence of ammoniacal salts, and to afford it full vigour it is sufficient to add to the foregoing mixture a certain quantity of oxide of iron. An excess of iron was injurious by partially drying the leaves and preventing the formation of the flowers. The carbonate of manganese, added in small quantities to the oxide of iron, produces very useful effects.

The utility of soda is not well demonstrated; however, it is certain that this alkali can be entirely substituted for potassa only to the detriment of the vegetation. In the same way magnesia cannot replace lime (Experiments 10 and 11).

Among the acids, sulphuric and nitric are necessary to the regular development of the plant (Experiments 13 and 14); silicic acid is indispensable.

To sum up, the fixed mineral matters absolutely necessary for the development of the vegetation of oats seem to be:—

Silica	Lime
Phosphoric acid	Magnesia
Sulphuric acid	Iron, and
Potassa	Manganese.

The author intends to determine, by further experiments, whether these mineral matters are likewise necessary and sufficient for the maturation of grains of oats, which almost constantly aborted in the foregoing experiments, perhaps on account of the season being far advanced. He purposes also to investigate the influence of chloride of sodium on the development of the plant.

ON THE PRODUCTION OF ORGANIC BASES FROM NITROGENOUS VEGETABLE AND ANIMAL SUBSTANCES.

By Dr. J. STENHOUSE.

[*Concluded from page* 249.]

By Boiling with Alkaline Solutions.—Starting from the facts hitherto stated, I think we have every reason to assume that, when in the dry distillation of vegetable or animal substances ammonia is produced in considerable quantity, it is always accompanied by simultaneously-formed organic bases. Now, since ammonia may be obtained, as is well known, from these substances by several other methods, it appeared by no means improbable that in these cases organic bases would likewise be formed. It has long been known that ammonia is given off in abundance when the nitrogenous constituents of plants or animals are boiled with strong alkaline leys. A certain quantity of beans was therefore boiled in a large still with caustic soda. They were soon converted into a dark-coloured mucilage, a consistence which proved a great hindrance to the progress of the distillation from the frothing and boiling over; it was therefore only possible to distil small quantities at a time and with a moderate fire. On carefully rectifying the distillate, a clear strongly alkaline liquid was obtained; it contained a large amount of ammonia, a small quantity of an agreeably-smelling aromatic oil, and a tolerable amount of organic bases. The liquid was neutralized with muriatic acid, and the oil separated by means of a moistened filter. On supersaturating with caustic potash, there

was obtained with the ammonia the organic bases partly floating on the liquid and partly dissolved in it. They had every resemblance to those obtained by dry distillation, but at present I am not able to say whether they are identical or not. Oil-cake was distilled in the same manner, and similar results were obtained; the same may, therefore, be expected from the corresponding nitrogenous parts of other plants.

Organic Bases from Flesh by Boiling with Caustic Alkalis.—A bullock's liver, cut into small pieces, was submitted to distillation with caustic soda. It dissolved quickly into a brown strongly-frothing gelatine, and a very alkaline liquid passed over, accompanied by an agreeably-smelling aromatic oil. On saturating the liquid with muriatic acid and evaporation, this oil is converted into a brown resin. The concentrated liquid furnished, on supersaturation with soda and distillation, an ammoniacal solution of oily bases, of which a quantity separated on the surface. At the present moment I am unable to state anything respecting their nature. The employment of caustic leys instead of dry distillation has, at least, the advantage that the bases are obtained at once free from empyreumatic oils and resins.

Production of Organic Bases with the Aid of Sulphuric Acid.—A small quantity of beans were digested with sulphuric acid, which had been previously diluted with three or four parts of water; they were soon reduced into a pasty mass. Care was taken not to allow the action of the sulphuric acid to proceed to the production of sulphurous acid. The acid liquid was supersaturated with carbonate of soda and distilled. The ammoniacal liquid which passed over likewise contained organic bases similar to those previously described.

Organic Bases by Putrefaction.—The author, who states that he has not yet had any opportunity to ascertain whether the production of ammonia in this case is accompanied by that of organic bases, observes that he should not be at all surprised if putrefaction were, from the less energetic kind of action, to prove the most advantageous method for the preparation of organic alkaloids on a large scale.

Guano.—An aqueous solution of Peruvian guano was submitted to distillation with an excess of caustic lime. The strongly ammoniacal distillate was neutralized with muriatic acid, and evaporated to about one third. After supersaturating with soda, it was again submitted to distillation. The product contained a small but still distinct trace of basic oil, resembling that obtained from other substances. It dissolved readily in muriatic acid to a perfectly clear liquid, and was again separated by alkalis. It appeared to be far more soluble in water than the previously-mentioned basic oils. The amount, however, was much smaller than I had expected, although guano must not be selected as a fair example of the effect of putrefaction on complex nitrogenous substances, as the greater portion of the nitrogen contained in it exists originally in the form of ammoniacal salts. The above experiment, nevertheless, shows that guano likewise contains volatile organic bases besides ammonia.

Starting from the above data, I think we may state with tolerable certainty that "in all cases where ammonia is produced in large quantity, either from complex animal or vegetable substances, it is constantly accompanied by the production of a larger or smaller quantity of volatile organic bases." When, therefore, seeds and leaves of different genera of plants are subjected to these or analogous processes, we have every reason to expect that the number of organic alkalis will soon be considerably increased.

Another conclusion which I think may be drawn with equal justice from these experiments is, that the nitrogenous principles of plants, as vegetable fibrine, albumen, caseine, &c., although very analogous, are, nevertheless, not identical with the corresponding principles of the animal kingdom, as otherwise their products of decomposition should likewise be identical. The same series of bases would have been obtained from beans and bones, as well as from other vegetable and animal substances, on submitting them to the same processes of decomposition. Since this, as we have seen, is not the case, I think I am justified in assuming that animal and vegetable fibrine, caseine, &c., although very analogous, are not identical substances, which has hitherto been the view entertained by some of the most celebrated chemists.

In carrying out the dry distillation both of animal and vegetable substances, great care should be taken to keep the temperature as low as possible; for I have frequently observed that when accidentally the heat was raised too high the organic bases were nearly entirely destroyed, so that in this case ammonia was almost the only alkaline product. I am, therefore, very much inclined to suspect that in many cases a considerable portion of the ammonia which is produced in the destructive distillation of animal and vegetable substances actually proceeds from the destruction of the organic bases. This becomes the more probable when we consider that the organic bases have a more complex composition than ammonia, and that they are almost entirely converted into ammonia when passed once or twice over heated charcoal. In the same manner, when the organic alkaloids are heated in contact with potash or soda, or even when merely their aqueous solutions are boiled for a certain time, they always experience a partial decomposition, ammonia being constantly produced.—*Liebig's Annalen.*

PEAT-CHARCOAL IN AGRICULTURE.

The value of charcoal in husbandry, and especially peat-charcoal, has often been recognised. So long ago as 1846 the Royal Agricultural Society awarded a prize for an essay on peat-charcoal as a manure for turnips and other crops to Mr. Hugh Raynbird. Instances of the effect of peat-charcoal in producing rapid vegetation of seeds, particularly in dry weather, were stated in that paper, and suggestions and directions made for burning peat-charcoal on farms where peat is found. That had, of course, only a limited application. But Mr. Rogers's plan, to which we lately adverted, of producing charcoal from Irish peat, in a finely pulverized state, at the cost—delivered in England—of 50s. a ton, together with its proved efficacy in deodorizing nightsoil, has given the subject an agricultural importance it has not hitherto possessed. We learn that a company has been formed and incorporated for working this plan on a large scale, so that we may look for some vigour in bringing the subject before the farming community. Heretofore nightsoil has been an unmanageable agent. Its fertilizing properties are well enough understood, but the practical difficulty of its transport has ever been the bar to its more general use. Mr. Rogers shows that his peat-charcoal completely and instantaneously disinfects it, and brings it into a form not more offensive, and not less portable, than guano. In a lecture delivered by him at the Mechanics' Institute on Monday, the 22d ult., Mr. Rogers entered at length into the agricultural uses of peat-charcoal, both alone, and in combination with nightsoil. He said:—

"Early in the year 1845 I first brought the question of the value of peat-charcoal as a fertilizer of the soil under public consideration, in a report then published, which had been previously made by me to the relief commissioners of Ireland, on the subject of the bog-lands of that country; and let me premise that what I speak of is peat-charcoal, not peat-ash, which has long been known and used, and is totally different from charcoal. My investigation of the question was induced by experiments which had been made at the Botanical Gardens at Munich, in 1844, by wood-charcoal applied there to aloes, pelargoniums, &c. Seeing the effect produced by wood-charcoal, it immediately occurred to me that, if peat-charcoal possessed a fertilizing power, a mine of wealth lay upon the surface of the country. I tried my experiments, and one and all were successful."

Dr. Lindley tried and approved of it. Mr. Newton, in Carlow, and Mr. James Russel, in Donegal, tried peat-charcoal, on Mr. Rogers's suggestion, to potatoes, and found it most effectual in increasing the crop and preventing disease. Mr. Rogers said:—

"Mr. Russell commenced his experiments in 1846. He tried it with all the usual farm produce except wheat, which he did last year with uniform success, and as a top-dressing for grass-land he had fully borne out all I had stated in that respect; but his trial on a field of four acres, with potatoes, in 1847, was very remarkable. They were planted in ridges, or, as termed here, 'lazy beds;' one half the field manured with farmyard manure, the other with peat-charcoal only, about a handful thrown on each seed. The result was more than a double crop from the charcoal; and he informed me that he was himself so astonished at the fact that he requested Lord Donegal to see and vouch it. At my suggestion he planted oats the next year in the whole field without any further manure, and he assured me the increase on that portion manured with charcoal was nearly in the same ratio as the potatoes. Now, what is the cause? Simply this. The charcoal lay on the land throughout the winter. Every shower of rain that came brought ammonia and common salt in abundance. This continued for the winter months, and when spring came every grain was rich in nutriment, while it held moisture besides, to give it to the seed at once, and stimulate it into growth."

Satisfied of the fertilizing power of peat-charcoal, Mr. Rogers experimented on its property of preventing putrescence, which he found it to possess in a very high degree. Of the chemical composition of the compound produced by mixing peat-charcoal with nightsoil, he said:—

"At our last meeting I proved to you that the amalgamation of peat-charcoal and excretiæ produces an inoffensive mass capable of being packed in bags, and transported by any conveyance. I would now pray attention to what that compound contains. I do not hesitate to say it is richer in fertilizing powers than any other manure that can be produced. The components of peat-charcoal are carbon, hydrogen, nitrogen, oxygen, sand and clay, oxide of iron, phosphoric acid, silicate of potash, chloride of sodium, carbonate of lime, sulphate of lime, &c., possessing, as a whole, the power of absorbing, deodorizing, and retaining for the uses of vegetation, the components of human excretiæ, &c.; phosphate of ammonia, phosphate of lime, phosphate of magnesia, phosphate of soda, phosphate of iron, chloride of sodium and alkaline sulphate, sulphate of lime, sulphate of soda, sulphate of potass, hydrochlorate of ammonia, lactate of ammonia, free lactate acid, urea, uric acid, animal matter, mucus, earthy phosphates, &c. Is it possible to conceive anything richer in the essentials for vegetation?"

He then proceeded to give a second demonstration of the deodorizing character of the charcoal:—

"Sir Charles Aldis, Dr. Gros, and Mr. Cuthill, florist, of Camberwell, having been appointed judges, experiments were proceeded with to show the deodorizing properties of the peat-charcoal. The machine was put in motion by manual power, and in an incredibly short space of time a quantity of excretory matter, mixed with charcoal, had passed through it in the form of a dry black powder, the volatile gases which it originally possessed being entirely neutralized, and the substance itself rendered completely odourless. A quantity of excretiæ was then placed in the hopper of the machine to which we have already alluded, as was also a quantity of Irish peat-charcoal. After a little time the combined materials quitted the machine through a tube into a trough, having been formed into a

dry dusty manure, and perfectly without smell. Sir C. Aldis then reported that the judges were of opinion that the experiments had been fairly and properly made, and that they were most successful; and Mr. Cuthill said he had carefully examined the machine before the experiments were made, for the purpose of ascertaining that they were conducted fairly, and he must say that he considered it a most marvellous discovery."

Mr. Rogers stated that the supply in Ireland would be practically inexhaustible, and he repeated his former statement that it would be delivered in London at £2 10s. per ton.—*Economist.*

THE RECENT PATENT FOR PEAT CHARCOAL.

We are enabled, through the attention of Mr. Richard Telford, of the Scottish Patent-office, to lay before our readers the substance of the specification of Mr. Jasper Wheeler Rogers, civil engineer, Dublin, for certain improvements in the preparation of peat as a fuel, and, in combination with certain substances, as a compost or manure.

We may, however, premise that we have been informed by Mr. Slight of various attempts made in the compression of peat, with a view to its preparation for fuel, &c., and abandoned on account of the difficulty and expense, as well as unproductiveness, of the process—especially an attempt at Coalston, with two hydraulic engines. The Earl of Strathmore, Lord Willoughby d'Eresby, and others, have made similar unsuccessful efforts. Lord Meadowbank's operations with peat-moss were principally directed towards the formation of his well-known compost heap. His name is, however, inseparably connected with the discovery of the uses and application of peat-ashes; although we have heard a competent judge, the present Marquis of Tweeddale, publicly declare the production of peat-ashes of little practical value, from the immense quantity of peat required to yield a small quantity of ashes. Indeed, if Mr. Slight be not in error, Mr. Rogers informed him that even he only got some two tons of peat-charcoal from forty cubic yards of peat-bog. We confess we had formed, from the statements of Lord Ashley and Mr. O'Gorman Mahon, a higher opinion of the lignate character of Irish peat; and are not much afraid of our poorest Scotch peat yielding charcoal at this rate. As we have, however, hinted before, the richer veins of peaty matter are by no means unknown in Scotland. Mr. Gardiner, at Barrochan, tells us of a seam of rich black bog-candle existing in Borrochan Moss; and we formerly noticed the black candles from Binny, exhibited at the Covent-garden free-trade bazaar in 1845.

This invention refers, 1, to a series of operations, constituting a new system of preparing peat as a fuel, which, when charred, is particularly applicable to forges, fires, &c.; and, 2, to the manufacture of peat of granulated charcoal, and to the admixture thereof with animal excrement, for the purpose of deodorizing the same, and making a diluted inodorous manure.

Before commencing to cut peat in large quantities from a bog or peat-moss, it is first necessary to drain the bog, so that the operation of cutting may be more safely and advantageously carried out; and this the patentee states he is generally enabled to do at the time of cutting the peat for manufacturing purposes, without a separate outlay for draining, by proceeding in the following manner:—

After having ascertained the level of the bog so as to find the natural outfall of the water, the cutting is commenced by taking out blocks of peat, averaging from four to six inches long by three to four inches square, which are to be afterwards converted into fuel. The cutting is carried on so as to form a number of trenches of any given length, and as nearly parallel to each other as the position and circumstances of the land will allow, commencing as nearly as possible to the natural outfall. These trenches are formed from 100 to 1,000 feet, or more, apart, according to the nature or depth of the bog; and, in the first instance, they are made about four feet wide and four feet deep—a sufficient fall being given to each drain to run off the water which may drain into the trenches. These trenches having been multiplied, and cut to a length sufficient to drain that portion of the bog which is to be first cleared, the upper crust or surface of the peat-moss is removed transversely, for about one fourth of the space between the trenches, to the depth, at first, of about two feet; and thus alternately the peat is continued to be removed from the trenches in a longitudinal direction, and from the intermediate portion of the bog in a transverse direction, each cutting being about two feet deep, by which means the bog is prevented from falling in by lateral pressure; and the drainage of the whole is effected by terraces or steps, which are thus formed by degrees in the bog, and which provide for the drainage of the water from the general mass. After this process has been carried into effect over the whole surface of the bog or peat-moss to be reclaimed, the surface or crust which has been left uncut between the trenches is cut away over the whole extent of the bog under reclamation, commencing at the points nearest to the natural outfall. When the surface or crust has been removed, the second step or terrace is taken away in the same manner, then the third and fourth, until the whole peat is removed; and the substratum can then be made fit for cultivation.

Having explained the mode of cutting the peat from the bog, the patentee next proceeds to describe the means employed for drying and preparing the peat.

In a portable shed of wood and wicker-work, open at the ends and sides, but having a waterproof covering at the top of any convenient flexible material, which also hangs over the side, the peat, cut from the bog in blocks of a suitable size, is placed in order that the blocks may be partially dried by the action of the wind. The blocks are placed, immediately on being cut from the bog, on trays of wood, or wire, or wicker-work, as may be most convenient; and the trays are piled one above the other in the portable shed, to the sides of which handles are attached for carrying the shed from one place to another, or its bottom framing may be furnished with wheels, if thought necessary. The sheds are placed in exposed positions, so that the air may circulate around and through them, and thereby drive off the moisture from the peat. When the peat has been thus exposed for a few days, according to the season and the state of the weather, the shed, with its load, is removed to the drying station, where it is unpacked, and the peat is piled upon clamps to receive an artificial drying in kilns or frames erected over an excavation made in the ground, and forming a continuous ash-pit from one end to the other of the shed. The sides of the shed are secured by brickwork or masonry, and on either side a rail is laid to form a way for the ready passage over the pit of a series of furnaces or chambers intended to receive the peat which is to be charred, and which, when ignited, gives off heat sufficient to dry the peat piled within the shed. These furnaces or chambers are formed of sheet iron, or any other suitable material, having a quadrangular framing at bottom, provided with firebars, or perforated plates, or other similar contrivances, as may be found most convenient. The sides of these chambers incline inwards, pyramidically; but, although square-based chambers or furnaces are preferred, circular-based or conically-shaped furnaces will also be found effective. Each chamber is made moveable by being mounted on wheels or otherwise, so as to be taken out of the air-chamber to admit of the peat being packed in the chamber or furnace, which is done most conveniently by turning it over on its side, and packing it through the bottom. These furnaces are placed within a space or chamber, formed by slanting iron plates placed immediately over the ash-pit, and forming a continuous air-chamber from one end to the other of the kiln or shed. There are doors for closing the ends of the chamber, which must be of a sufficient capacity to allow of an air space all round each furnace. And there are plates on the sides, pierced with rows of holes, decreasing gradually in diameter upwards. The fire-boxes are stationed at equal distances apart on the line or tramway, and immediately beneath vertical pipes or funnels attached to the upper part of the chamber, formed of the perforated plates. These pipes are intended to receive and surround the several pipes which carry off the smoke or gases from the burning fuel within the fire-boxes. The upper end of each of the pipes is closed so as to confine the heated air which would otherwise pass rapidly off; but an opening is made in the cover or closing-plate, to allow of the inner pipes sliding up and down freely in guides provided for that purpose. The object of giving the pipes this motion is that they may be drawn upwards out of the way of the fire-boxes as they are moved into the shed; but when these boxes are arranged in their proper positions the pipes are lowered so as to fit over the circular openings formed in the tops of the fire-boxes. There are slanting beams which form the skeleton of the frame on which the peat is piled. The peat to be dried is piled up on either side of the air-chamber to such a height as the shed admits of; and, in order to keep rain or the moist atmosphere from falling upon the peat, and yet allow the wind to act upon it when the artificial heat is not being employed, a covering, composed of a series of shutters, overlapping each other when closed, somewhat like a Venetian blind, is constructed, which may be readily opened or closed at pleasure. These shutters are made of any convenient length (two, three, or more sets, placed side by side, will be required to cover the whole of one side of a shed), and they are furnished at the ends with pivots which drop into sockets cut in the sides of the slanting beams, and support them in their places. Rods are temporarily connected to the ends of the shutters, and are intended to open and close a series of them simultaneously by the action of a lever. Legs hang from the under side of the shutters, and lie in a recess cut in the shutters to receive them when the shutters are closed; but when the shutters are opened the legs keep them in that position by resting respectively on the shutter immediately below. By this means a sort of ladder is formed up the outer side of the shed, and the workman is thereby greatly facilitated in the operation of filling in the peat.

In effecting the piling of the peat, he first covers the floor of the shed and kiln with the blocks, and piles them up as high as he can conveniently reach; he then puts the lowest shutter in its place by dropping its pivots into the sockets cut in the side-framing of the shed, and places a block or blocks under the shutter, to keep it up and form a step; the upper shutters having legs, as before stated, are then applied as required, and form steps for the workman to reach his work with convenience. He then proceeds alternately to pile up the blocks of peat in the shed, and to apply the shutters, until the shed is filled, and the shutters are all put in their places. The side-rods for opening and closing the shutters are then attached, and the artificial drying is ready to be commenced. The ash-pit is entered by a door, and the peat in the fire-boxes or chamber is fired from beneath the fire-bars; the dampers situated immediately above the pipes being raised by means of their respective rods to effect a proper draught for ignition, and closed down tightly when the fires are required to be extinguished. As soon as the peat to form the charcoal is fired, care must be taken to regulate the combustion so that it shall proceed slowly, according to the ordinary mode of charcoal-burning. This may be readily effected by means of the ash-pit door and the dampers, which place the operation completely under the command of the attendant. While the fires are being supplied with air (which passes along the

ash-pit and between the fire-bars), the chamber formed by the perforated plates also receives a supply; and this air, being in contact with the heated surfaces of the fire-boxes and the flues, will become quickly heated, and pass off through the holes in the plates, and distribute itself through the mass of piled peat; at the same time the air surrounding the fire-boxes will form a packing, and prevent the peat which is near the fire-boxes from being burnt or injuriously affected by the contiguous fires. When the heated air is distributed through the mass of peat, it will quickly drive off the greater portion of the aqueous particles which remained therein from the first drying operation, and complete the preparation of the peat for domestic or ordinary uses.

In some cases, instead of applying the heat obtained from the burning of charcoal in the furnaces, the patentee employs a blast of air for drying the peat. For this purpose he mounts a fan-wheel, or a shaft in connection with the air-chamber, and drives it with great velocity, taking care that there shall be no vent for the wind but through the perforations in the plates of the air-chamber. The blast will thus be distributed equally through the mass of peat, and drive off the vapour, or, instead thereof, the fan is made an exhausting fan, and a partial vacuum is produced in the chamber, the effect of which is to induce a current of air to flow through the pile of peat, and the aqueous particles flow into the chamber.

To effect the consolidation of peat for dense or consolidated charcoal, an arrangement of machinery, consisting principally of a presser and framing of cast-iron standards, attached to a bed-plate, is employed. In order to effect the operation of pressing the peat with the least possible exertion of power, an exhausting apparatus, acting simultaneously with the pressing apparatus, is employed to draw out the air, and any aqueous matter that may yet remain in the peat at the time that the plunger is descending upon the block of peat.

In order to solidify the dust or small particles of peat charcoal (which, in the general manufacture, is produced in large quantities), and render it applicable as fuel, mucilaginous matters, composed of animal and vegetable gluten, albumen, or starch, are intermixed with the dust or small particles, in the proportions of about two parts of glutinous or mucilaginous matters to about eight parts of charcoal. This operation may be advantageously effected by means of an ordinary pug-mill, and by the employment of a moulding machine in connection therewith, or by panel-moulding. The combined charcoal may be moulded into bricks or cakes, or into forms to resemble wood, which are then dried by any convenient means.

Hitherto we have dwelt only on the first part of Mr. Rogers's specification; the second head of the invention may probably be as interesting to many of our readers. It refers, as before stated, to the manufacture of granulated peat-charcoal, to be used as a deodorizing agent, and, in combination with certain substances, as a compost or manure.

It is well known that, as a general manure, that which contains the largest amount of ammoniacal salts is the most valuable; but, inasmuch as these salts are very volatile, they are generally lost by evaporation, according to the present mode of treating and using, as a manure, animal excrement, which contains these valuable properties in abundance. It is also known that animal excrement cannot be properly used as a manure without dilution. Now, the patentee has ascertained, by many experiments, that peat-charcoal possesses considerably greater absorbing powers than the generality of wood-charcoal; and that, by reason of the strong affinity which exists between carbon and ammoniacal and other gases, the odours arising from animal excrement are taken up and destroyed, when contact and intimate admixture with the charcoal take place.

In manufacturing the peat into granulated charcoal, to be used as an absorbent of the ammoniacal gases arising from animal excrement, and for diluting the same sufficiently to make a useful marketable manure, the patentee proceeds in the manner before described for obtaining peat-charcoal; and, when so obtained, he subjects it to the operation of grinding, until it is reduced to grains about equal in size to those of coarse gunpowder. He then employs it in the following manner:—In order to retain all the volatile products and other fertilizing properties, so as to apply them beneficially to the purposes of agriculture, granulated peat-charcoal is intermixed by hand labour, or by any convenient machine, with animal excrement,—the charcoal being used in such quantities as will be sufficient to absorb the aqueous and volatile products of the excrement and destroy the effluvium. To obtain these results, and prepare a marketable manure of such a strength as will be immediately available for agricultural purposes, there is added to the excrement an amount of peat-charcoal exceeding in weight that of the excrement: thus, two parts, by weight, of charcoal, and one part, by weight, of excrement from towns, will be found to produce an inodorous manure; but the patentee does not confine himself to these proportions, so long as the desired result is obtained by adding an excess, by weight, of peat-charcoal to animal excrement. By this means an apparently dry, powdered, inodorous mixture is obtained, of sufficient strength (or rather dilution) to be advantageously applied, either to arable or pasture land, and which is capable of transport in barrels or sacks by the ordinary modes of conveyance. To prevent the evils which arise from the odours of animal excrement of towns, the granulated charcoal may be applied to the separate receptacles for such matters, either in the entire quantum required to destroy the effluvium, or in such quantity as will prevent injurious exhalation; and thus render it more convenient for transport to a place where the process of perfect mixing can be conveniently carried into effect.

Peat-charcoal may likewise be advantageously employed as an absorbent of the sewage-water from farmyards and stables, and also as an absorbent of other kinds of liquid manure.

The patentee claims:—

Firstly. As respects the drying of peat, the employment of moveable sheds for protecting the trays of cut peat from the weather, and yet allowing a current of air to pass between and over the layers of peat, so as to partially dry the peat before it is removed from the bog lands to the station.

Secondly. The peculiar construction of drying-shed above described, with reference to the drawings, for drying peat (whether such shed be made to contain one or more clamps or heaps of piled peat), whereby the peat will be protected from the weather,—the moisture when driven off from the peat will be allowed to escape into the atmosphere,—and, when required, air may be allowed to circulate freely around the pile of peat; also the arrangements of fire-chambers (or charcoal-burning chambers) and air-chambers above described, or any analogous arrangements, whereby the heat given off by the charred peat is made available for evaporating the moisture from fresh-cut peat; and further, the use of the perforated chamber and fan-wheels, for extracting or evaporating the moisture from piles of peat by exhaustion, or by the application thereto of a blast of air.

And, as respects the manufacture of charcoal, whether for the purpose of fuel, or as an ingredient for a manure, the patentee claims the charring of peat in chambers or vessels, as above described, whereby the admission of air thereto, when the combustion of the peat has proceeded to an extent sufficient to produce carbonization, may be readily cut off, and the fire quickly extinguished.

With respect to the machinery for compressing peat-fuel, he claims the arrangement of parts constituting the compressing-machine, as described with reference to the drawings; and particularly the application to such machine of an exhausting apparatus, whereby the extraction of the air and aqueous particles contained in the substance under operation may be effected simultaneously with the compression of the mass.

And lastly. As respects the combination of peat-charcoal with certain substances, as a compost or manure, the patentee remarks, that he is aware it has been proposed to mix with earths and a variety of refuse materials charcoal-dust, charred saw-dust, and other analogous vegetable matters, in small quantities; but this has been rather for the economical employment of the charcoal-dust and other analogous matters, which would be otherwise useless, than for effecting a defined and previously unattained object. He therefore wishes it to be understood that he lays no claim to the broad principle of employing peat-charcoal as an element in the manufacture of manure; but he claims the application of peat-charcoal (by preference granulated) to animal excrement, in such quantities as shall deodorize the same, by chemically retaining the volatile gases in the manure; and also the admixture of peat-charcoal in such quantities and proportions with animal excrement as shall produce a dry pulverulent manure, suitable, without the addition of other ingredients, for the manuring of arable and meadow land.—*Scottish Agricultural Journal.*

THE CHEMICAL TIMES.

SATURDAY, NOVEMBER 3, 1849.

THE ARCTIC EXPEDITOR.

It is the fate of every *originator*—every inventor of a great plan—whether for the regeneration of mankind—whether for the advancement of science—to be derided and pooh-poohed by the quidnuncs and the pseudo-savans of the age in which he lives. There are those still living who have made light of the notion of locomotives travelling at the rate of twenty-five miles an hour, and laughed to scorn the idea of our streets being lighted by the combustion of gas. The world has so wagged, and thus we have no doubt the world will wag. Less doubt have we that many who peruse what we are about to write will deride the plans and the ideas of the gentleman we shall name as utopian, and denounce them as impracticable.

Our attention has been lately called to a proposition made by Lieutenant Gale, R.N., the well-known aëronaut, for the discovery of the mislaid and almost given-up expeditions of Sir John Franklin and Sir James Ross. His plan is this:—He will proceed to some given point (not too high in latitude) in the Arctic regions in a vessel fitted out for the purpose. There, during the short summer, he will make partial and independent ascents in a balloon well secured against any contingencies of the climate, and there he hopes and believes to be able to discover some landmarks, some data, however slight, of the whereabouts of the missing expeditions. In a partial ascent he could attain the altitude of one mile, the control of the balloon being secured by a line or rope manufactured of the best Italian hemp (which is second only to silk in strength and elasticity). Independent ascents he undertakes to effect to the extent of *one hundred miles in any direction;* and with these advantages, provided with the best telescopes, with the means of signalling (by means of *pétards*) to an immense distance, and favoured by the clear atmosphere and the perpetual day-

light of the polar regions (in summer), would it be extravagant or utopian to suppose that he might be able to obtain some information which would set him at least on the track of the lost navigators? We may add that his balloon, or balloons (for supplementary ascents might be made), would be inflated with hydrogen gas (generated, of course, on the spot), which, enabling to take up an immense amount of ballast, would give him unusual facilities for ascent and descent. The cars would be water-proof, and provided with *sleigh-runners*, thus rendering them capable of being utilized as vehicles for purposes of locomotion. Should he be fortunate enough to discover any trace of the expeditions, he would at once wend his aërial way towards some part in Canada or the United States (easy, as every geographer will know, of access), and from thence embark in-continent on shipboard, and carry the glad news to England.

Thus far we have endeavoured to explain and to elucidate the principal features o Lieut. Gale's most courageous proposal. We offer no opinion as regards its feasibility ourselves. We leave it to our readers and correspondents to pick holes in its details, and to ca at the possibility of its being carried out. Mr. Gale has written to Lady Franklin explaining his plan and his motives: he has also addressed himself to the Marquis of Northampton and the Earl of Rosse; and we are sure that those exalted personages will not pass his proposal over without at least attentive consideration—without at least liberal criticism.

We have written. Should the lieutenant's plan be adopted (for the means to carry out which he must, of course, be indebted to the generous support of the Admiralty and of the public)—should it *succeed*—he will have rendered not only an important benefit to science, but a no less important one to humanity. He will have demonstrated and proved the fact that balloons are not mere scientific toys, and that aërial navigation is capable of higher things than the espionage of hostile armies or the amusements of Vauxhall *badauds*. He will have solved an important problem (perhaps discovered the north-west passage); he will have ennobled the profession to which he belongs; and last, though not least, he will have solaced and relieved the aching heart of many an anxious wife, of many a widowed mother, and restored to the arms of a loving and a courageous spouse as brave an officer and as true a man as ever wore the British uniform.

REPORT OF THE ROYAL COLLEGE OF PHYSICIANS ON CHOLERA.

The following report of the cholera committee, appointed some time since by the Royal College of Physicians, has been agreed to, and circulated amongst the members of the college:—

Royal College of Physicians, Pall-mall East, Oct. 27.

Sir,—The following report was, in substance, laid before the cholera committee on the 17th instant, and we were then authorized to send copies of it to the members of the college. The epidemic was already rapidly declining, and it seemed desirable to make known the results of our inquiry before the opportunity of verifying them should be lost. On the same evening Mr. Busk communicated to the Microscopical Society his observations on the identity of some forms of the "cholera bodies" with a species of uredo, the contents of bran-cells and starch grains respectively. Mr. Marshall's examination of bran-cells was made subsequently, but independently of Mr. Busk's. The statements of both these gentlemen have been embodied in the report, together with the fact that the smallest "cholera bodies" are derived from chalk—a result to which we were led by the remarks of Dr. Griffiths on their physical and chemical characters.

We have the honour to be, sir,
Your obedient humble servants,
WILLIAM BALY, M.D.
WILLIAM W. GULL, M.D.

To Dr. ——.

"REPORT ON THE NATURE AND IMPORT OF CERTAIN MICROSCOPIC BODIES FOUND IN THE INTESTINAL DISCHARGES OF CHOLERA.

"We propose in this report to lay before the committee the results of some experimental inquiries on a subject which, within the last few weeks, has engaged much of the attention of the profession. We allude to the discovery by Mr. Brittan and Mr. Swayne, of Bristol, of peculiar bodies in the 'rice-water' dejections of cholera patients, and to the statement that similar bodies have been found by Mr. Brittan in the atmosphere, and subsequently by Dr. W. Budd in the drinking-water of infected localities.

"These observations, on account of their important bearing, if true, on the pathology of cholera, seemed to us to demand a searching examination. We have accordingly given much time and attention to the subject. Having, in the first place, satisfied ourselves of the distinctive characters of the bodies found in the rice-water dejections, we next sought to verify the observations of Mr. Brittan and Dr. Budd with reference to their presence in the air and drinking-water of places infected with cholera. It was necessary that this part of the inquiry should not be delayed; for the epidemic had already reached its turning point, and it would, before long, have been difficult to obtain favourable opportunities for experiments of a satisfactory character.

"Our inquiries were afterwards directed to the nature and properties of the newly-discovered corpuscules, and to the question of their occurrence in other diseases. In this investigation we soon perceived that objects totally different had been regarded as identical; but we had arrived at no positive conclusion respecting those which seemed most characteristic of the cholera evacuations, when we received two important communications on the subject from Mr. Marshall and Dr. Jenner.

"Our observations on the air and drinking-water of infected localities, twenty-five in number, gave uniformly negative results. With regard to the value of our experiments, taken separately, it will, we think, appear that many are liable to no objection. Some of those which relate to the drinking-water of infected places are certainly wanting in the conditions which would make them convincing. But when it is considered that Dr. Budd believes he has detected the objects sought for, 'in great numbers,' in such large bodies of water as the Float at Bristol, and the Surrey Canal, and that he represents them as being deposited in the sediment of the water, we shall not be thought unreasonable in having expected that they might be discovered in the cisterns of houses and public institutions in which cholera had prevailed severely, although it had ceased there for some days or weeks.

"Nevertheless, a much larger amount of evidence would have been required to disprove the statements to which our observations refer, had those statements been unassailable from other points. But the facts to be detailed in the subsequent part of this report will show that the bodies found in the rice-water dejections have no peculiar relation to cholera; and that, if they should occasionally be present in the atmosphere, or impure water, this will not happen exclusively, or even especially, in districts infected with the epidemic.

"We shall now submit the particulars of all the observations to the committee, describing first those on the air.

"MICROSCOPIC OBSERVATIONS ON WATER CONDENSED FROM THE ATMOSPHERE OF INFECTED LOCALITIES.

"Two methods were employed for condensing the aqueous vapour. One was, to suspend in the air to be examined a glass funnel, nearly filled with a freezing mixture, its lower opening having previously been closed by a cork and covered with sealing-wax. The moisture condensed on the outside of the funnel trickled into a small phial placed beneath. The second method was to force air slowly, by means of bellows, through a bent glass tube immersed in ice and salt, when the moisture was deposited on the interior of the tube, and collected in a bulb at its lower part. In either way from half a drachm to a drachm of water was readily obtained.

"The water condensed from the air in the several localities and under the circumstances we have described was in each case examined by us more than once. But the search for annular bodies, such as those found in the cholera dejections, failed, as we have already intimated. Neither cells, nor rings, nor anything bearing a resemblance to them, could in most cases be discovered. We saw merely portions of gelatiniform matter containing bright points—sometimes finely granular, brownish masses, perhaps derived from smoke—and occasionally colourless, transparent particles of a crystalline appearance, which may have been portions of siliceous dust. After the water had been kept some time, chains of delicate oval vesicles, like those of the torrula of yeast, but much smaller, appeared in it. These were absent at first, and could not be mistaken for the cholera discs. Equally unlike those discs were the three or four separate oval cells, which, in two instances, were seen in the water when first examined. They had a clear, single outline, and were not flattened.

"The uniform result of these experiments, as of the former series, was negative. No bodies were found which could be regarded as identical with the more characteristic of those discovered by Messrs. Brittan and Swayne in the rice-water dejections of cholera. The objects met with were far more numerous than those seen in the moisture condensed from atmosphere. The sediment, when viewed with a 1-8th inch object-glass of Ross, or 1-16th inch object-glass of Powell and Lealand, presented, besides amorphous matter, an almost endless variety of organic forms, both animal and vegetable. Amongst these were many round or oval cells, of various dimensions, and some separate rings of minute size, colourless, and pellucid. The cells had generally very delicate walls and a clear cavity, were never flattened, and often contained a multitude of distinct granules, which, in some instances, presented the molecular motion. Like the rings, these cells were obviously different in their nature from the thick-edged discs, which the descriptions and drawings of Messrs. Brittan and Swayne and Dr. Budd had led us to regard as the characteristic corpuscules of the cholera evacuations.

"The negative results of our search in the atmosphere of infected places for objects identical with those just referred to are confirmed by some observations communicated to us by Mr. Marshall. While cholera was prevalent in St. Giles's he examined the dirt washed from the broken glass of windows, and from cobwebs taken from houses in that district, in which deaths had occurred from four to ten days previously. With a 1-12th inch or 1-8th inch object-glass he found a vast number of objects, such as particles of silex and soot, hairs, wings, and legs of insects, round and oblong cells of a brownish colour, very dark spherical granular masses, probably of a conferyoid nature, and fragments of

vegetable tissue, amongst which were pieces of spiral tubes, and entire rings, apparently of woody tissue, of an oval, polygonal, or circular form. But he detected no discs with double outline. A microscopic examination of the objects collected on a moist surface from the atmosphere of sewers gave Mr. Marshall a similar negative result with regard to those discoid bodies; although he found (besides fine particles of silex and other dust) brown, oval, and round cells, single and in couplets, minute colourless vesicles, either single, double, or in triplets, a single large oval cell, and numerous opaque granular confervoid bodies, of a brownish or blackish green colour.

"MICROSCOPIC OBSERVATIONS ON THE 'CHOLERA FUNGI.'

"We next proceed to show how various are the bodies which have been confounded together under the terms annular bodies (Mr. Brittan), cholera cells (Mr. Swayne), and cholera fungi (Dr. Budd).

"On examining the drawings given by the three gentlemen who have called attention to the subject, four principal forms, which can hardly belong to the same objects, may readily be distinguished.

"1. Rings, which enclose a free area, and which often are broken. These are usually of a minute size, but are occasionally large.

"2. Globular or oval cells, chiefly of the middle size, which have a thick wall with numerous small eminences on its surface, and contain a granular mass, in some instances separated by a clear space from the wall of the cells. These are distinctly figured only by Mr. Swayne, but are regarded by him as perfectly developed cholera cells.

"3. Bodies having the form of discs, with thick rounded edges, and centres of indistinct structure. These vary extremely in size, including some of nearly the smallest, as well as many of the largest, of the objects represented by the three observers. They predominate in all the representations given of the corpuscules of the rice-water dejections, and must be taken as the type of the bodies discovered by Messrs. Brittan and Swayne.

"Large broken cells, having apparently homogeneous membranous walls, and containing small, well-defined, oval bodies; figured by Dr. Budd as cholera fungi undergoing decay, but differing in character from all the other objects represented.

"A mere inspection of these different figures would suggest strong doubts as to their representing different appearances of really identical bodies in different states or stages of development or decay. The more particular description we have now to give of each kind of body will demonstrate that they are of various and distinct nature.

"1. The rings, when closely examined, are seen to be of different kinds, some perfectly continuous in their entire circle, others formed by a curled fibre; some round, some oval, others lozenge-shaped. Some of these have been traced to their true source by Mr. Marshall, who has found that exactly similar objects may be prepared by the artificial digestion of the vegetables used as food; such as cabbages, potatoes, and onions, the withered style of wheat grain, and portions of cane in sugar; the spiral and annular tissues of which break down into rings of different sizes, or coils resembling rings.

"Intermediate between these and the third class of bodies are minute oval, or round, colourless corpuscules, which have an annular appearance; but, on a close inspection, are seen to have their area filled up with a transparent substance, presenting sometimes perforations. In some specimens of the rice-water fluid, oval bodies, in part having their middle filled up as here described, and in part mere rings, exist in extraordinary abundance. The rings of these bodies have been observed by Mr. Busk and Dr. Griffiths to be divided by cross lines into segments, which Mr. Busk thinks are bead-shaped; an appearance which had occasionally been noticed by ourselves, as well as by Mr. Marshall. They are calcareous structures, originally derived from chalk, in which they abound; and they have been introduced into the contents of the intestines with the medicines (chalk mixture, aromatic confection, &c.) which the patients have taken.* These minute bodies from the chalk are, of course, not found in all cases; and we may think it not unlikely that, in their absence, the separated nuclei of animal and vegetable structures, as well as the vegetable rings above described, may sometimes have been mistaken for fungi. The microscopic bodies from chalk are, however, the most striking in their characters; and, we believe, are those which have been chiefly regarded as representing the first stage of the cholera fungi.

"The brown globular bodies, with tesselated surface and thick wall, have been clearly identified by Mr. Marshall with the spores of different kinds of uredo, the rust, smut, and bunt of grain, some species of which may be found, not only about the withered style on grains of wheat, but also in almost every specimen of corn and bread. Mr. Busk has made the same observation, and identifies them with the uredo segetum, or bunt.

"Discs, with thick, elevated, and somewhat irregularly-curved margins; the central area flattened, and obscurely granular. They have generally a yellowish or pale brown tint, which varies in depth with the colour of the fluid containing them. These are the most peculiar of the bodies found in cholera, and differ from the rest in being more or less soluble in ether. Mr. Marshall, who first informed us of this fact, found that the smaller discs undergo nearly complete solution, leaving a cavity in the dried mucus, whilst the larger ones leave a fine granular film. They are apt to break across, and the thick margin to curl inwards. They are evidently not cells, nor have they any organized structure which could give them any claim to be regarded as living organisms. On the other hand, their solubility in ether shows that they consist, in great part, of some substance of the class to which the fats, resins, and saponaceous matters belong. This observation led Mr. Marshall to examine different fatty substances, and at length to find that curled concretions, not unlike the discs found in cholera, could be obtained by compressing a piece of rich cheese (with or without the addition of ether) between two plates of glass. We are not yet able to account for the origin of these peculiar discs. Mr. Busk regards them as altered starch grains. It is, at all events, certain that they are not fungi; and, as we shall afterwards see, that they are not peculiar to cholera.

"Besides these fatty discs there are sometimes met with yellowish bodies, which might easily be confounded with them, but which are merely rendered more pellucid by ether. Bodies of similar character have been shown by Mr. Busk to arise from a disintegration of the bran of wheat, and Mr. Marshall has independently made the same observation.

"Under the fourth class of bodies we refer to those represented by Dr. Budd as the cholera fungi undergoing decay and disintegration. They are evidently of a different nature from those figured by him as characteristic of the fresh cholera dejections. The mode of disintegration of the two classes of bodies is quite distinct: the so-called cholera bodies, after resisting the action of water for some time, break up into irregular granular masses, whilst the decomposing bodies depicted by Dr. Budd seem to be in part homogeneous, membranous cells, dehiscing; and are, perhaps, starch-cells. The rings are, most probably, parts of disintegrated vegetable tissue.

"It is shown by Mr. Marshall, and had before been noticed by Boehm and others, that cells like fungi, or their spores, are occasionally found in the excretions in cholera. These, however, have a more delicate structure than any of the bodies described as characteristic of cholera, and are totally different from them. It is well known that various vegetable forms are apt to become developed in organic fluids generally.

"From a review of the foregoing facts, it is obvious bodies found in cholera dejections have been confounded, and described as identical. It is also shown that many are traceable to an extraneous source, and that even the discs placed in our third division are not fungi. The statement that the bodies found in the cholera dejections present an endogenous multiplication has, in all probability, arisen from confounding them with the ureds, or from mistaking the appearances produced by the small bodies seen through, or upon, the larger ones, or entangled in their substance.

"We are unable to identify the rings obtained from the air and figured by Mr. Brittan with any of the bodies included by him under the term 'annular bodies.' Our own experiments have satisfied us that these bodies do not commonly exist in the atmosphere of infected places, but the observations of Mr. Marshall on the dirt collected from windows and cobwebs show the great variety of matters which must be wafted about in the air in the form of dust, and which might, in different instances, be caught with the condensed moisture.

"The bodies represented by Dr. Budd as being found in impure drinking-water have the form of discs with thick edges. We have ourselves never seen such bodies in water. But, when it is remembered that the contents of bran-cells sometimes assume that form, the occasional presence in water of bodies capable of being confounded with the discs derived from the discharges of cholera will not appear remarkable.

"Had the bodies described by Messrs. Brittan and Swayne been proved by the foregoing investigations to be of fungoid nature, yet the facts we have now to add would have shown that they have no necessary connection with cholera. In the first place, they seem not to be constantly present in the discharges. It is, indeed, remarkable that in those dejections which, from the absence of colour, have usually been regarded as the most characteristic of the disease they are frequently absent. We have failed to find them in several instances. In one a portion of every evacuation was set apart, and examined several times by each of us, and yet in neither portion could we detect them.

"A still more important fact, which, from the explanations already given, might be anticipated, is, that all the more remarkable of the bodies which have been thought peculiar to cholera exist in the intestinal evacuations of persons affected with other diseases. Dr. Jenner first demonstrated to us their presence in great abundance in the dejections of a patient affected with typhoid fever. We have since verified his observation in five other cases of this disease. We have also satisfied ourselves of the existence of some of the forms in dejections apparently healthy, from two patients in Guy's Hospital,

* "It is right to state how we arrived at the knowledge of these facts. Dr. Griffiths had pointed out to us that the bodies in question are heavy, polarize light, and are soluble in dilute nitric acid. He suspected that they were oxalate and phosphate of lime. Mr. Marshall subsequently showed us that acetic acid also dissolves them readily, and that sulphuric acid acts on them, producing needles of sulphate of lime. Having ourselves found the same bodies in the evacuations of two patients suffering from typhoid fever, we were examining them in company with Dr. Griffiths and Mr. Marshall, when the demonstration of their calcareous nature reminded us of the fact that these patients had been taking medicine containing chalk, and, at the same time, brought to our recollection the remark made to one of us by Mr. Topping, that Mr. Brittan's 'annular bodies' were to be found in chalk mixture. Accordingly, we examined a portion of medicine containing aromatic confection, and afterwards a piece of common chalk, and in both found the bodies described above, though not the larger discs which are also found in the rice-water fluid."

one suffering from bronchitis, the other from early cirrhosis of the liver; and Mr. Marshall has detected small annular bodies 'in the mucus covering the healthy excrement' of several herbiverous animals. It is obvious that bodies derived from such various sources will not commonly be found all present together. This, indeed, is not the case in cholera. And it is also clear that those belonging to chalk will very rarely be met with, except that substance has been taken as medicine.

"We shall now briefly restate the principal results we have arrived at, and submit the conclusion which seems to be justified by them:—

"1. Bodies presenting the characteristic forms of the so-called cholera fungi are not to be detected in the air, and, as far as our experiments have gone, not in the drinking-water of infected places.

"2. It is established that, under the term 'annular bodies' and 'cholera cells, or fungi,' there have been confounded many objects of various and totally distinct natures.

"3. A large number of these have been traced to substances taken as food or medicine.

"4. The origin of others is still doubtful, but these are clearly not fungi.

"5. All the more remarkable forms are to be detected in the intestinal evacuations of persons labouring under diseases totally different in their nature from cholera.

"Lastly. We draw from these premises the general conclusion that the bodies found and described by Messrs. Brittan and Swayne are not the cause of cholera, and have no exclusive connection with that disease; or, in other words, that the whole theory of the disease which has recently been propounded is erroneous, as far as it is based on the existence of the bodies in question.

"W. Baly, M.D., } Cholera
"W. W. Gull, M.D., } Sub-committee."

MANUFACTURE OF ACETATE OF SODA.

A cold concentrated solution of acetate of lime (which it is desirable should be made from distilled acid) is to be treated with a concentrated filtered solution of sulphate of soda, sp. gr. about 1.250; temperature 98°; and agitated well by machinery, if convenient, during the precipitation of the sulphate of lime, till a little of the liquor from the decomposing vessel in which this operation is conducted will not show any precipitate on the addition of a solution of sulphate of soda in a test-tube. When this takes place, the contents of the decomposing vessel must be run on to a back, and then filtered into a cistern. Two of these backs will be required, if the manufacture is conducted on a large scale, each furnished with a cistern, as it will require a good deal of washing to get all the acetate of soda from the sulphate of lime; they are to be furnished with false bottoms, and filters of stout twilled flannel. It is immaterial whether they are made square or round; the former is most convenient where it is desirable to economize room; each ought to communicate with both cisterns; so that, when one back has ceased to pour strong liquor into one cistern, the pipe may be stopped with a plug, and that communicating with the other cistern opened for receiving the washings of the backs. It may be ascertained when the precipitate is sufficiently washed by the taste of the liquor running away from it into the weak liquor cistern: when it is tasteless, or nearly so, the sulphate of lime must be dug off with a wooden spade or shovel (iron is apt to cut the flannel), the back is then ready for another batch from the generator.

The liquor is now to be pumped from the cisterns into the iron pans, which ought to be so cast that they may offer as much heated surface as possible, and yet be not too large for a man to keep their contents in a state of brisk agitation (with an iron stirrer broad and flat at the end); as it approaches dryness, the temperature should not much exceed 500°. Great nicety is required in this part of the manipulation, which depends entirely on the skill of the workman. Having thus dissipated the tar, the dry acetate may either be at once converted into acetic acid, or dissolved and crystallized; it is more soluble in the latter condition. It is most conveniently dissolved in a large cylindrical lead vessel, heated by shooting steam into it; when the solution is concentrated, it may be run through a flannel filter into the top of a course of steamers, furnished with coils of $\frac{3}{4}$-inch lead pipe. These vessels are made of 4lb. sheet lead, eased in boards. The best size is about 24 ft. long, 4 ft. wide, and about 9 inches deep. The pipe should be coiled from one end to the other, and go up and down about three times. Too much pipe cannot be used, as the rapidity of the evaporation depends upon the quantity employed. As the evaporation proceeds, the liquor ought to be syphoned from the top to the second, and afterwards to the third, steamer, and thus make room for more bulky weak liquor; from the dissolving lead, when a pellicle appears on its surface, it should be syphoned off into leads, and left for a couple or three days (according to the season), to crystallize. These leads need not be of heavier metal than 4 lbs., and made 4 ft. long, 2 ft. wide, and 9 inches deep; but their form must depend entirely upon the size of the crystals required. Should they be wanted larger than can be obtained in the above, the leads must be deeper, packed in sawdust, and allowed to stand a longer time. When the crystallization is complete, the mother liquor must be taken from the crystals, and emptied into the dissolving lead, and with the addition of two or three times its weight of water, used in dissolving fresh fused salt from the torrefying pans; the crystal must then be cut out of the leads, and thrown into a conical-shaped drainer and well washed. The liquor caught from the drainer must be put into the dissolving lead also. The crystals are now to be removed from the drainer to the drying-stove, where, after having been a few hours on the shelves, they should be packed in casks, and the sooner they are sold or used the better, as by keeping a loss of weight is sustained by deliquescence.

In some manufactories of the acetate of soda the salt is not exposed to igneous fusion, but purified from all extraneous matter by repeated crystallizations and filtrations through animal charcoal, previously well washed with dilute hydrochloric acid. The following process has been employed in the Combrook Works, near Manchester, under the able superintendence of Mr. A. P. Halliday:—

The rectified pyroligneous acid is saturated with lime, and the resulting solution of acetate of lime boiled down to sp. gr. 1.200. This solution is now dosed with sulphate of soda, obtained from the decomposition of acetate of soda by sulphuric acid, until there is no further precipitate; sulphate of lime falls down, and acetate of soda remains in solution. The sulphate of lime is thrown upon stone filters, 12 feet by 6 feet, and washed with water until the solution comes off so weak as not to be sufficient to afford remuneration for the expenses of labour, &c.

The solution of acetate of soda, along with the washings of the sulphate of lime, is next boiled down in iron pots, 6 feet long by 3 feet deep, cold set, until its sp. gr. reaches 1.300. During evaporation the excess of sulphate of soda is fished up in ladles, pierced full of holes, and the salt laid on drainers suspended over the pot from which it had been raised. The solution, at 1.300 sp. gr., is allowed to settle over night, and then drawn off to crystallize. The crystals are dissolved in dilute pyroligneous acid, and the solution, at 1.270, drawn off after settling for a fresh crystallization; the crystals are again dissolved, drawn off at sp. gr. 1.500, dried and fused. The solution of fused salt is evaporated down, crystallized, and the crystals again dried and fused, and the fused salt allowed to flow out into an iron plate, where it becomes solid, and is afterwards broken up and dissolved in water; this solution, when dosed with sulphuric acid, yields pure acetic acid.

Mitscherlich recommends the solution of acetate of lime to be of sp. gr. 1.116, and the solution of acetate of soda to be evaporated to 1.230 or 1.240, and then put aside to crystallize. Thompson gives 550° Fahr. as the temperature of the fusing point. Turner recommended the saturation of the rough pyroligneous acid with the sulphate of sodium as the most economical process, but the offensive nature of the sulphuretted hydrogen gas evolved in this process has prevented its adoption on the large scale.

Dumas recommends that the fused acetate should be dissolved in water until the solution has acquired a sp. gr. of 1.116; the solution should then be allowed to settle for twelve hours, the clear liquor poured off, boiled down to 1.250, and set to crystallize.

HEALTH OF LONDON DURING THE WEEK.

[From the Registrar-General's Report.]

The total number of deaths registered in London in the week ending last Saturday was 902; the weekly average of five autumns is 1,162; the present return, therefore, shows a decrease of 260 deaths on the estimated mortality of the season. The numbers in the last three weeks, during which the mortality has continued to fall below the average, have been successively 1,075, 1,028, and 902. In last week only 25 deaths from cholera were registered; the numbers returned in the first three weeks of October were respectively 288, 110, and 41. Of the 25 deaths of the week, one occurred in the sub-district of Long-acre, two in the district of Pancras, one in Islington, one in the workhouse at Lower Homerton, one (after puerperal peritonitis) in Cock-court, Bishopsgate, three in the district of Shoreditch, three in Bethnal-green, two in Whitechapel, four in St. George-in-the-East, one in Stepney, two in Poplar, and one in each of the following districts:—Bermondsey, St. George (Southwark), Lambeth, and Camberwell. The deaths from diarrhœa and dysentery in the last week were 51; the average is 27; their continuous decline is shown by the numbers returned in the first three weeks of October, which were 146, 105, and 63. Typhus was fatal in 52 cases; the weekly average is 56. From small-pox there were seven deaths (about a third of the average); whilst those from measles, scarlatina, and hooping-cough, were respectively 20, 33, and 16, the three epidemics exhibiting at present only half of the usual mortality. The mortality from phthisis is also much less than the usual amount. Besides a case of cholera, already referred to, the deaths of thirteen women, after childbirth, were registered in the week.

The reading of the barometer was 30 in. on Wednesday; the mean reading of the week was 29.87. The mean temperature has been throughout the week higher than the average of the same week of seven years; on the last five days it was from 9 to 12 degrees higher than the average of corresponding days. The mean of the week was 55 degrees.

Death of Mr. Thomas Morton.—Our readers will regret to learn that this estimable gentleman expired suddenly at his residence, Woburn-place, Russell-square, on Tuesday morning, the 30th ult., in the 36th year of his age. Mr. Morton was deservedly well known to the medical profession by his numerous and valuable contributions to the advancement of science. The lamented deceased succeeded his illustrious relative, the late Mr. Cooper, the author of the "Surgical Dictionary," as surgeon to the Queen's Bench Prison, and at the time of his decease held also the appointment of assistant-surgeon to the University College Hospital. Mr. Morton was admitted a member of the Royal College of Surgeons on the 24th of July, 1835, and so highly were this young man's professional acquirements esteemed that he was elected by the council an honorary fellow of the institution. Mr. Morton leaves a widow, the only daugher of the late Mr. Samuel Cooper, to deplore his loss.

STATEMENT IN CONTINUATION OF THE ONE PUBLISHED IN THE CHEMICAL TIMES OF OCT. 27, 1849, SHOWING THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE AIR FROM OCT. 21 TO OCT. 27 INCLUSIVE, AS INDICATED BY THE EVAPORATION OF WATER FROM TWO COPPER VESSELS OR SCALES, ONE INSULATED AND THE OTHER NOT. ALSO THE READING OF THE BAROMETER, THERMOMETER, DIRECTION OF WIND, AND GENERAL STATE OF THE WEATHER.

Oct., 1849.	Barometer.		Therm.		Scales.				Wind.		General state of weather.
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Insulated	Non-Insulated	Morning.	Evening.	
21	29.75	29.95	55	52	..	10 N.	..	10	SW.	SW.	Heavy rain all the morning; rather fine afternoon; fine evening.
22	30.05	30.05	50	58	. .	20 I.	20	. .	W.	S.	Fine till 2 P.M.; showers afternoon; fine evening.
23	30.07	30.13	58	58	10 I.	10 I.	20	..	SW.	SW.	Fine, but rather cloudy, all day.
24	30.13	30.13	58	57	..	..	..	..	SW.	SW.	Fine all day.
25	30.02	29.90	58	60	10 N.	5 I.	5	10	SW.	SW.	Ditto - rain evening.
26	29.80	29.85	58	53	10 I.	5 N.	10	5	SW.	SW.	Ditto.
27	29.90	30.10	54	59	15 N.	5 I.	5	15	SW.	W.	Rain and overcast all day.

The cholera having virtually disappeared the working of the scales may now be referred to meteorologically, and between them and the weather will be observed a remarkable coincidence. To fully appreciate their value, however, in this respect they must be personally consulted, more especially in reference to the fluctuations in the barometer, and changes in the weather, which generally follow the scales.

Westminster-road, Oct. 30, 1849. Franklin Coxworthy, Author of "Electrical Condition," &c.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Charles Alexander Broquette, Rue Neuve St. Nicholas, St. Martin, France, chemist, for improvements in printing and dyeing fibrous and other materials. Patent dated April 21st, 1849.

These improvements refer to the employment of nitrogenous compounds obtained by the decomposition of milk or the muscular parts of animals (or, in other words, to the use of the causeum of the ancients). The mode of application is as follows :—Ten pounds of the nitrogenous compounds are mixed with from fifty pounds to sixty pounds of water and one pound of ammonia. The compounds are, however, first boiled for twenty minutes in a portion of the water, and, when they are partially cooled down, the ammonia and remaining portion of the water are mixed with them, and the whole well stirred up together, after which they are mixed up with three per cent. of olive oil and two per cent. of an alkaline earth (by preference lime), when they are ready for being used with a colour not injuriously affected by the lime or ammonia. Steam is then applied, to cause the compounds to coagulate on or in the texture of the fabric. The yarn may, if desired, be saturated with the compounds previously to its being woven into a fabric, which is afterwards to be dyed or printed.

Claims.—1. The employment of nitrogenous compounds in combination with an alkaline earth in the dyeing and printing of cotton and other vegetable fibrous materials.

2. The employment of nitrogenous compounds, coagulated by heat alone or by chemical agents, for the impregnation of vegetable fibre.

Louis Vernet, Buenos Ayres, for a method of preserving from destruction by worms, insects, decay, and fire, certain vegetable and animal substances. Patent dated April 24th, 1849. Enrolled October 24th, 1849.

This invention consists chiefly in impregnating, saturating, or coating the substance to be preserved with a weak solution of arsenic, alone or combined with other materials. The solution is obtained by boiling an arsenious acid in water until it is dissolved and the fluid becomes clear and transparent. The proportion of arsenic to water is one pound to forty gallons, and care should be taken not to allow the fire to touch the sides of the boiler above the water, which would cause the arsenic to sublimate, and act injuriously on the health of the workman. The quantity of water evaporated should be replaced by the same quantity of fresh water, in order that the relative proportions above mentioned may be maintained. Or, a concentrated solution may be formed by dissolving one pound of arsenic in five gallons of water, which can be preserved for any length of time in wooden vessels until required for use, when every five gallons must be diluted with thirty-five gallons of water. The article may either be immersed in or washed over with the solution, and then dried, whereby it will acquire a thin coating of arsenic, which will be imperceptible to the senses, but a sufficient preservative against the ravages of insects, &c. Or, it may be impregnated with the solution by exhaustion or pressure. When the solution is required to dry quickly, six pounds of alum to one pound of arsenic are dissolved in it.

To preserve timber from fire, it is to be impregnated with a solution of one pound of arsenic, six pounds of alum, and ten pounds of potass, in forty gallons of water.

To preserve timber immersed in water from decay and the ravages of the worm, it is to be painted over with the solution mixed with oil or any suitable tarry matters.

Claims.—1. The use of weak, simple, arsenical solutions to preserve animal and vegetable substances from insects and decay.

2. The use of weak arsenical solutions, in conjunction with other matters, or with oil or tar, to preserve animal and vegetable substances from fire and worms.

James Castley, for improvements in the manufacture of varnishes from resinous substances. Patent dated January 11th, 1849. Enrolled July 11th, 1849.

The first part of this invention consists in manufacturing a strongly adhesive and perfectly water-repellent varnish from resin spirit and gutta percha.

Three parts by weight of the gutta percha of commerce are put into a pot with nine parts of crude resin spirit (obtained by the destructive distillation of common resin), and subjected to a heat of from 120° to 140° F., the mixture being stirred occasionally until the gutta percha is dissolved. The varnish thus produced is suitable for coating coarse fabrics, such as tarpaulins, rick-cloths, &c.; but, to obtain a varnish suitable for fine articles, the patentee substitutes for the crude resin spirit above mentioned a rectified resin spirit, obtained by passing a current of steam through the crude resin spirit until the condensed product which comes over attains a specific gravity of about 0.870; at which point the process of distillation must be stopped, as all products of a higher specific gravity will be injurious to the quality of the spirit.

The second part of this invention consists in manufacturing a colourless varnish from resin spirit and gum damar, or from resin spirit and gum mastic.

The patentee mixes resin spirit, which has been rectified by steam in the manner above described, with from one tenth to one sixth of its weight of sulphuric acid of not less than 1.700 spec. grav., and thoroughly agitates the mixture; then he rectifies the spirit again by a current of steam, when the spirit comes over in a colourless state; after which he dissolves the gum damar or gum mastic in about four times its weight of this purified rectified spirit, with the aid of a gentle heat. An inferior varnish may be obtained by using resin spirit which has undergone only one process of rectification and has not been treated with sulphuric acid.

PATENTS RECENTLY GRANTED.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF SCOTLAND, FROM THE 22D DAY OF SEPTEMBER TO THE 22D DAY OF OCTOBER, 1849, INCLUSIVE.

John Mason, of Rochdale, in the county of Lancaster, machine-maker, and George Collier, of Barnsley, in the county of York, manager, for certain improvements in machinery or apparatus for preparing and spinning cotton, and other fibrous materials; and also improvements in the preparation of yarns or threads, and in the machinery or apparatus for weaving the same. Sealed September 24th, 1849; six months.

William Parkinson, of Cottage-lane, City-road, in the county of Middlesex, successor to the late Samuel Crossley, for improvements in gas and water meters, and in instruments for regulating the flow of liquids. Sealed September 24th, 1849; six months.

James Aitken, of Cook-street, in the city of Glasgow, North Britain, manufacturer, for certain improvements in the preparation of cotton and other yarns for weaving, and in the machinery employed therein. Sealed September 27th, 1849; six months.

John Robinson, of Patterson-street, Stepney, in the county of Middlesex, engineer, for improvements in machinery for moving and raising weights. Sealed October 3d, 1849; six months.

Ernst Grapel, of Birmingham, in the county of Warwick, esquire, for improvements in marine vessels, in apparatus for the preservation of human life, and in moulding, forming, and finishing hollow and solid figures, composed wholly or in part of certain gum, or combination of certain gums; also improvements in dissolving the aforesaid gums, and in apparatus or machinery

to be used for the purposes above mentioned. Sealed October 8th, 1849; four months.

Robert Clegg, Joseph Henderson, and James Calvert, of Blackburn, in the county of Lancaster, manufacturers, for improvements in looms for weaving. Sealed October 8th, 1849; four months.

Thomas Lightfoot, of Broad Oak, within Accrington, in the county of Lancaster, chemist, for an improvement in printing cotton fabrics. Sealed October 11th, 1849; six months.

William Gaspard Brandt, of No. 16, Compton-street, Brunswick-square, in the county of Middlesex, for improvements in the construction of the bearings of railway engines, and railway and other carriages now in use. Sealed October 11th, 1849; four months.

George Henry Dodge, citizen of the United States of America, but now residing at Manchester, in the county of Lancaster, for certain improvements in machinery for spinning and doubling cotton, yarns, and other fibrous materials, and machinery or apparatus for winding, reeling, balling, and spooling such substances when spun. Sealed October 15th, 1849; six months.

Charles Shepherd and Charles Shepherd, jun., both of Leadenhall-street, in the city of London, chronometer-makers, for certain improvements in working clocks, and other timekeepers, telegraphs, and machinery, by electricity. Sealed October 15th, 1849; four months.

Thomas Beale Browne, of Hampden, in the county of Gloucester, gentleman, for certain improvements in looms, and in the manufacture of woven and twisted fabrics. Sealed October 15th, 1849; six months.

David Christie, of St. John's-place, Broughton-lane, in the borough of Salford, in the county of Lancaster, merchant, for welding and uniting cast iron with steel and malleable iron. Sealed October 19th, 1849; six months. (Communication.)

George Park Macindoe, residing at Mountblow, in the parish of Old Kilpatrick, and county of Dumbarton, for certain improvements in machinery or apparatus applicable to the preparation, spinning, and doubling or twisting of cotton, wool, silk, flax, and other fibrous substanees. Sealed October 19th, 1849; six months.

Joseph Stovel, of Suffolk-place, Pall-mall East, in the county of Middlesex, tailor, for improvements in coats; parts of which improvements are applicable to sleeves of other garments. Sealed October 19th, 1849; six months.

Frederick William Norton, of Lascelles-hall, Lepton, in the parish of Kirkeaton, in the county of York, fancy cloth manufacturer, for improvements in manufacturing plain and figured fabrics. Sealed October 19th, 1849; six months.

John Combe, of Leeds, in the county of York, civil engineer, for improvements in machinery for heckling, earding, winding, dressing, and weaving flax, cotton, silk, and other fibrous substances. Sealed October 22d, 1849; six months.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF IRELAND, FROM THE 21ST DAY OF SEPTEMBER TO THE 20TH DAY OF OCTOBER, 1849, INCLUSIVE.

James Warren, of Montague-terrace, Mile End-road, in the county of Middlesex, gentleman, and Willoughby Theobald Monzani, of St. James's-terrace, Bermondsey, in the county of Surrey, gentleman, for improvements in the construction of bridges, viaducts, and aqueducts; and in anchors; and in drilling and boring braces. Sealed September 27th, 1849; six months.

Robert Plummer, of the town and county of Newcastle-on-Tyne, manufacturer, for certain improvements in machinery, instruments, and processes employed in the preparation and manufacture of flax and other fibrous materials. Sealed October 1st, 1849; six months.

John Holland, of Larkhall-rise, in the parish of Clapham, in the county of Surrey, gentleman, for a new mode of making steel. Sealed October 6th, 1849; six months.—(Communication.)

USE OF COLOURED GLASSES TO ASSIST THE VIEW IN FOGS.—The following curious observation is made by Luvini, of Turin, in a letter to the editor of *L'Institut*, at Paris. If it be verified, it may prove to be of importance to geodetical operations, as well as in observations at sea:—"When there is a fog between two corresponding stations, so that the one station can with difficulty be seen from the other, if the observer passes a coloured glass between his eye and the eyepiece of his telescope, the effect of the fog is very sensibly diminished, so that frequently the signals from the other station can be very plainly perceived, when, without the coloured glass, the station itself could not be seen. The different colours do not all produce this effect in the same degree. The red seems the most proper for the experiment. Those who have good sight prefer the dark red, those who are short-sighted like light red better. The explanation of this effect seems to depend upon the fact that the white colour of the fog strikes too powerfully upon the organ of sight, especially if the glass have a somewhat large field. On the contrary, by placing a coloured glass between the eye of the observer and the eyeglass of the instrument, the intensity of the light is much diminished by the interception of a part of the rays; the observer's eye is less wearied, suffers less, and consequently distinguishes better the outlines of the object observed."

CHICORY.—After a taxed article passes the Custom-house, the first effect of the tax paid for its admission is to afford the dealers a premium for its adulteration. The use of chicory, in the proportion of about two ounces to sixteen ounces of coffee, is admitted to be an improvement both of flavour and wholesome nutrition; but the adulteration often extends to one half, and even two thirds, of chicory to a third of coffee. In whatever proportion it is mixed, it is a fraud on the consumer to sell the cheap article, chicory, at the price of the dear article, coffee. But chicory is itself subject to duty, 20s. per cwt. (from forty-five to fifty per cent. on its cost price), and is itself the subject of an extensive and foul adulteration. In its pure state it is the root of the Chicorium intybus, one of the dandelion tribe of plants, and is, in proper quantity, a good tonic and aperient. In this respect it counteracts certain qualities of coffee not esteemed as wholesome when used in a strong decoction. In France it was used in the *café* before it was known in England. It was introduced here by those who discovered the means of preparing "coffee as in France," and, last year, 12,000,000 lbs. of it were sold for 36,000,000 lbs. of coffee. But those twelve million pounds of chicory were pure. They were in a condition to enrich the quality and aroma of the refreshing cup, only they bore a most suspicious disproportion to the coffee. But what would their disproportion in quantity be, and what the base fraud in the coffee-cup, when the twelve million pounds of chicory were adulterated with a preparation of carrots, parsnips, burnt bran, sawdust, and other vegetable matter, and old worm-eaten ship biscuits? These are highly roasted and ground, and burned sugar and molasses added to them to heighten their flavour. So extensive is the use of those ingredients said to be, that cautious inquirers fear to repeat the extraordinary allegations. English-grown chicory, of the best quality, is worth 25s. per cwt., but the retail grocer can buy adulterated at 14s. per cwt., ready for mixing. It has been suggested that consumers should have a hand-mill, and purchase their coffee, and the proper quantity of good chicory unground. Perhaps the richer and the middling classes of society do so. But the multitude, who buy their supply "newly roasted and ground," in ounces, from day to day, and upon whom the fraud of adulterated coffee and adulterated chicory falls, do not use coffee-mills. Many of the poorest could not afford the cost of them. It has been said that in this, as in many other things, the destruction of the poor is their poverty. But, in this case, the beginning of the fraud is the premium afforded by the indirect taxation on coffee and chicory. The working classes prefer the best coffee if they can obtain it. For it is a fact known to merchants that they send more of the higher qualities of coffee, compared with the inferior, into the factory towns of Lancashire and Yorkshire, than to towns or country districts of equal population elsewhere. The growing of chicory in our own fields, free of duty, is now exciting some attention. And already it has been proposed to the Chancellor of the Exchequer, by the colonial coffee-planters, who seem to be tender-hearted for the interest of the poor coffee-drinkers, that, to prevent the undue admixture of chicory, that of home growth should be subjected to an excise duty of 4d. per lb. This, they reckon, would at least produce £200,000 annually to the Exchequer. But, as the plant is chiefly grown by gardeners, or in the spare corners of farmers' fields, or in cottage gardens, an army of inland revenue officers, sufficient to survey the whole kingdom, would swallow up the greater part, if not the whole, of £200,000. Moreover, the common dandelion, growing by the wayside, in the meadow, or in the field, almost everywhere, is such a near relative of chicory as to be substituted for it in a manner that even the connoisseurs of the French *café* cannot tell the difference. The moderate use of chicory has greatly increased the consumption of coffee. The only rational method of preventing or lessening their adulteration is to abolish the duties on both, and supply the deficiency in the Exchequer by direct taxation.

TO CORRESPONDENTS.

"A Novice."—A very easy and elegant way of taking the impressions of medals and coins is as follows:—Melt a little isinglass glue with brandy, and pour it thinly over the medal or coin, so as to cover its whole surface; let it remain on for a day or two, till it has thoroughly dried and hardened, and then take it off, when it will be found fine, clear, and as hard as Muscovy glass, and will have a very elegant impression of the medal or coin. It will also resist the action of damp air, which occasions all other kinds of glue to soften and bend. If the wrong side of the isinglass be breathed on, and gold-leaf applied, this will adhere, and will be seen on the other side, producing a very pleasing effect. Isinglass glue made with water instead of brandy will do *nearly* as well.

"B."—You will find an abstract of the specification respecting improvements in varnishes in this number.

"Alpha."—1. Of course. 2. Nitro-muriatic acid. 3. Graham's "Elements of Chemistry."

"Mr. Davis."—Take of bruised galls, 3 pounds; gum and sulphate of iron, of each 1 pound; vinegar, 1 gallon; water, 2 gallons. Macerate with frequent agitation for fourteen days. To produce 3 gallons. This ink is very good.

"Mr. Holt, Billericay, Essex."—The gas blowpipe used in the autogenous soldering purpose is admirably adapted for brazing, but the heat produced by it is too violent for glass-blowing purposes.

"W. C. T."—Nos. 145, 146, 147, 152, and 154.

THE CHEMICAL TIMES is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary or scientific communications to be addressed to the Editor, 320, Strand.

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ORIGINAL SERIES.

PHYSICO-CHEMICAL PHILOSOPHY.

ABSTRACT OF A LECTURE

BY PROFESSOR FARADAY.

The various forces which unite in a substance are, by the mind of man, abstracted, regarded separately, and classified according to some general resemblances or differences which the mind thinks in them. We are thus accustomed to refer some of the properties of matter, by which it acts upon and changes other matter, to the general head of chemical action; while others, we say, take place according to physical laws. But let us forget for awhile this distinction, and look again at the phenomena of nature as if no artificial arrangement had been invented for speaking of them; and, to assist the conception of these properties, I affix on the black board behind me a little shining speck, sufficient to indicate the presence of an object existing at a definite point, but nothing more. To this sensible object, which we at present only recognise as something capable of having properties attributed to it, we will ascribe, as we go along, the different characteristics which attach to matter.

The first object which we will examine for natural forces is water; since, as far as we can see, this substance is capable of furnishing us with every property found in matter as such; and because, as in water and steam, it presents the three great conditions of matter existing on this earth—the solid, liquid, and gaseous conditions. The first attribute we notice in matter is gravity, a most extraordinary property, although the phenomena of gravitation are the most familiar of all natural appearances. By virtue of the law of gravitation the beam in the scale descends, and illustrates the mutual attraction of bodies to each other, a tendency to approach their common centres. But this tendency may be as well illustrated by other means than by the mere descent of bodies—the collapse of an indiarubber ball, or the tension of a spring, may become the measure of the intensity of this force. Difference of weight is to be considered as nothing more than the result of the equal attraction of the earth acting on these masses. The pendulum is another illustration of the force of attraction, and also contains a provision for modifying its effect. A centripetal force is exerted, and, as the weight oscillates in an arc, the vibrations measure the force of gravity at the plane where it acts.

It is important to notice that the force loses nothing in character and amount by any change from one mechanical condition of matter to another; but is the same in ice, water, and in steam. If, by pouring some strong acid over marble, we cause a disengagement of a gas, such gas still has weight; when poured into a receiver, balanced in the scales, it depresses the beam on that side. A part of the marble becomes gas; but in so becoming it retains the primary property which belongs to it in a solid state, namely, gravity. But the amount of this force is as wonderful as its nature. When we look upon a small particle of matter, and reflect that its tendency is to act upon another particle, at a distance not merely of miles, but of many hundreds of miles, with a force which, though diminishing with distance, is never destroyed, it is impossible not to be filled with astonishment at the influence of this power of nature. The attraction of a body being proportioned to its mass, it follows that a man standing in this planet, and able to take a leap into the air, three feet from the surface of the earth, would, standing on the planet Ceres, be able to leap to a height of sixty feet, so small is the proportion of attraction which, in this instance, the mass would bear to the human body. The law of gravitation—*i.e.*, the fact that the force of attraction between bodies diminishes as the square of the distance increases—was first enunciated by Sir Isaac Newton. The attraction of the earth seems to us to neutralize all other attractions; but we must not conceive of this force otherwise than as the sum of the attraction of the several particles. The ordinary distances at which we are accustomed to perceive objects bear no proportion to the immense void through which the force of gravitation is capable of acting. Suppose two small pieces of lead placed at the same distance from each other as are our earth and the sun, they would still act on each other. It was on the faith of this universal law that in recent times a man who had observed certain perturbations in the course of the most remote planet of our system was satisfied of the existence of another then unknown planet, by which these perturbations were produced. The discovery of the new planet, by Adams, was not the result of his observations so much as of his mathematical reasoning, based upon the stability of the universal law. Moreover, the perturbations were not the work of some unknown body acting on the sun, but that of two of the smallest bodies revolving round it, both of which were subject to the attraction of the central orb.

From gravity we may pass to inertia, a property of matter by which it tends to remain in whatsoever state it is placed, whether of motion or of rest. If we take two elastic balls, and suspend them from points in the ceiling, at a distance equal to the diameter of one ball, and, setting them in motion in opposite directions, cause them to meet at the point nearest the ground, the motion will cease; but this takes place, not by any destruction of the force, for this is impossible, but by its resolution.

Looking minutely into the constitution of bodies, we find them to be made up of particles, in some bodies all of one kind, in others of many kinds. Taking water again as an illustration, we are able to separate its elements, by means of the voltaic battery. By electrolysis we are able to divide the water into two unequal parts, both gaseous. One of these vapours is highly combustible, and very light; it is called hydrogen; the other is heavier, will not burn of itself, but will cause another substance to burn with intense heat, and to emit a bright light; this we call oxygen, and the two are the elements of water. Having, by means of the battery, torn asunder the two parts, we are able to estimate the amount and proportions of each; two volumes of hydrogen are found in proportion to one of oxygen. Both are gases; both have a gravitating power. Oxygen is the most abundant of all elements; it exists in rocks, and in all animal and vegetable bodies. It has neither colour, taste, nor odour; it combines with all the other elements, in many proportions. By mixing chlorate of potash with one fifth of its weight of peroxide of manganese, and applying a gentle heat, oxygen may be made to come over, just as it has done in the voltaic trough. This subtle form of matter has been found to have a definite weight, 100 cubic inches weighing 34.6094 grains.

Hydrogen may be separated in several ways. The experiments with one battery have shown us one of these; another is to take a metal having a strong affinity for oxygen, such as tin. Place it in a vessel containing water, and add sulphuric acid; the result will be decomposition of the water, and oxygen and hydrogen will be given off. Hydrogen, unlike oxygen, will itself burn. Its specific gravity is widely different, 100 cubic inches weighing only 2.1318 grains. Since there can be present in water only the molecules which compose the two gases, how curiously must they be modified in the combined substance to be so heavy under one condition, and so light under the other. Such a drop as could hang at the end of a person's finger, when dipped in water, weighs about one grain; when the elements of this drop are separated by the battery, and become gaseous, such is their attenuation that they become of sufficient bulk to fill a large bottle. Even in this state the molecules of hydrogen have gravity. The relative weight of bodies will be shown to be very discrepant, by the following table:—

Hydrogen.....	1	—	—
Air	144	1	—
Water	11.943	829	1
Platinum	256.744	17.831	21.5

The power in virtue of which the molecules of hydrogen and oxygen combine to produce water is known by the name of chemical affinity. This power is very unlike the attraction of gravity; at the same time it cannot exist apart from it. All matter possesses this power of uniting with other matter, according to certain principles. Supposing a stone to fall to the earth, it may be there and form one mass with it; but if a body fall upon another, for which it has a chemical affinity, it not only becomes one mass with it, but, each parting with some of its properties, a new mass is produced, having qualities quite different from those which characterize the two bodies which go to make up the whole. Place a leaf of silver in a bottle containing chlorine gas, and in time (say a fortnight) gas and chlorine will have disappeared, and a new and distinct body have been formed. The particles of two bodies must be different, otherwise a mixture, and not a chemical compound, is the result. Although there takes place nothing of the pulling, pushing, or driving with which we often connect the word forces, there is no word more properly used to designate what is the cause of change. The alteration thus silently produced is as energetic and certain as those which attend the most violent efforts of mechanical power. The alteration which takes place by virtue of chemical affinity is the effect of the attraction of molecules for each other. With certain reservations, this attraction may be said to be an ever-present power. Its exceptions may be referred to two heads—to restriction and expansion; and are exemplified in what may be called instant and waiting attraction. If copper and chlorine are mixed, the former is at once burnt, and the chlorine disappears; the action, like that of gravity, is instant. The use of bleaching powder in purifying sick rooms is owing to the instant action of chlorine upon the floating poisonous miasma. Between oxygen and hydrogen the affinity is as great as between copper and chlorine, and yet these two elements of water may remain in contact for months, and never join to produce that substance. Affinity is in abeyance; it still exists, but it waits for the presence of some third substance, and then it acts. Such a substance is platinum; when this is brought into contact with the two gases, the whole are thrown into action, and water is the result. In like manner, the two elements of the atmosphere, nitrogen and oxygen, have a strong affinity, yet they remain in a state of mere mechanical mixture; and the only power by which we can unite them is the electric spark. When existing in a combined state, nitrogen takes oxygen most readily; if we take a jar containing oxygen and nitrogen, and throw oxygen in, we find not only action taking place, but the power of exerting affinity at the moment of contact; we find instant action. So, if we take the stopper out of a jar of nitrogen, it mingles instantly with the mixture of oxygen and nitrogen without, *i.e.*, the atmosphere.

ADDRESS BY MR. W. WHITE TO LORD KINNAIRD'S TENANTRY.

[*Concluded from page* 256.]

We have thus examined in detail, but, I trust, not without both profit and interest, the whole catalogue of vegetable constituents. The organic matter is found in plants in the proportion of from 90 to 99 per cent., whilst the inorganic or earthy constituents occupy only 10 to 1 per cent.; still both are equally demanded by the growing plant, and both are found to exist in various proportions in different plants. For instance, between the wheat, potato, and clover a great disproportion is discernible in the amount of various constituents each possesses. From this fact the chemist has arranged plants under certain heads according to the proportion of particular constituents they possess, as of silica, lime, and potash. I have here drawn up a table of proportions of elements which certain field plants remove from the soil in their growth; and to this table I beg your particular attention.

THE AVERAGE QUANTITY OF INORGANIC MATTER REMOVED FROM AN ACRE (ENGLISH) IN POUNDS.

		Potash.	Soda.	Lime.	Magnesia.	Phosphoric Acid.	Sulphuric Acid.	Silica.	Chlorine.	Azotized Matter.	Carbonized Substances.
Wheat...	Straw	23.83	..	11.90	..	1.99	18.24	129.13	5.77	69. 7	989.7
	Grain	8.71	3.32	1.03	4.41	18.32	2.34	.22	..	316. 8	768.5
	Total	32.55	3.32	12.93	4.41	20.31	20.58	129.35	5.77	386.15	1758.2
Rye	Grain.....	6.14	1.88	1.06	2.72	11.84	1.58	0.42	..	197. 1	871.2
	Straw	15.25	..	8.03	2.13	3.38	6.12	57.21	0.73	46. 0	1122.4
	Total	21.39	1.88	9.09	4.85	15.22	7.70	57.63	0.73	243. 1	1993.6
Barley..	Grain.....	13.29	4.28	2.60	6.85	30.39	2.75	24.68	0.38	315.53	1341.1
	Straw	55.64	2.10	19.04	8.91	8.08	31.02	116.21	23.51	81.40	2385.0
	Total	68.93	6.38	21.64	15.76	38.47	33.77	140.89	23.89	396.93	3726.1
Oats ...	Grain	8.36	..	1.59	5.24	10.07	3.95	31.98	0.35	242. 9	991.2
	Straw	13.36	14.66	8.01	5.03	2.13	16.42	59.58	2.74	54. 7	682.7
	Total	21.72	14.66	9.60	10.27	12.20	20.37	91.56	3.09	297. 6	1673.9
Red Clover		144.00	119.23	158.4	47.8	36.28	18.36	28.80	34.56	926. 0	563.7
White Turnip	Root	112.20	3.57	35.70	12.75	33.15	42.48	12.75	12.75	550.	3540.
	Top	21.14	1.50	18.27	5.32	1.13	10.29	4.40	2.33	..	—
	Total	133.34	5.07	53.97	18.07	34.28	52.77	17.15	15.08	?	?
Potato..	Tuber	100.44	..	6.51	17.11	27.90	13.78	11.16	10.78	529. 9	3996.0
	Top	2.26	1.13	32.48	5.38	6.45	4.74	33.68	2.57	90. 4	—
	Total	102.70	1.13	38.99	22.49	34.35	18.52	44.84	13.35	615. 3	?

You will observe that plants classify themselves according to certain proportions of constituents discovered in their composition, and, as the table shows, according to the proportion of these constituents they remove in their growth from the soil. In consequence of the excess of silica removed by a crop of barley or wheat, these are termed silica plants; whilst beet-root, mangel-wurzel, potatoes, and turnips, requiring a larger proportion of potash, are denominated potash plants; and other cereals, from a like cause, are named lime plants. This teaches you not only to manure your land, so as to put it in a condition best suited for the growth of the plant you intend to rear, but also the value of the principle of rotation of crops. If, disregarding the lesson thus developed, you attempt to grow a succession of similar crops, or even to cultivate wheat immediately after oats or barley, or grass after clover, unless the soil is in a very favourable condition, it will prove a failure. Without an acquaintance with the nature and condition of any particular soil, I could not lay down any specific rule for the management of your land. The foregoing are general rules, and only require attention on your part for still greater success. The chemist may not be a practical farmer, but there is nothing to prevent him rendering material assistance by pointing out causes of failure, and offering suggestions of a practical character for future success, both in the matter of recommending the crop most likely to prove remunerative, and the manure best adapted to restore fertility to an exhausted soil. There are still to be found remnants of soils which appear to demand the employment of fallowing; these are, however, becoming more and more rare. In Scotland there appears to remain less of this practice than in England. Chemistry enables you to determine whether, and when, fallowing is necessary. The object of fallowing appears to be to allow time for the action of the atmosphere on the soil, by which the earth, or, geologically speaking, the rock, becomes disintegrated or broken down, and, having combined with the constituents of the atmosphere, passes into a condition to afford the requisite food for future crops. The question now occurs, whether the desirable object could not be obtained more readily and more profitably by a judicious system of rotation, and the employment of specific manures? If fallows are ever requisite, it is upon cold, heavy, and retentive soils; but land of this quality may be much modified and improved by drainage properly applied. I say, properly, for whilst the greatest benefit has followed the application of drainage in some instances, there are not wanting others in which it has proved a signal failure. This has been when the principle was not well understood, or very indifferently practised. It is not possible to lay down a rule for all lands, all soils, and all climates; but I believe that, as a general principle, shallow is not productive of so much benefit as deep drainage. On the estate of the Earl of Carlisle, over which I have had frequent opportunities of making observations, accompanied by Mr. Henderson, his lordship's intelligent steward, drains of four feet average depth have been most successfully adopted; and so admirably are they laid down that, not only is the land efficiently drained, but Mr. Henderson has had tanks or reservoirs constructed, which are amply supplied with beautiful water for the cattle. I am of opinion that no permanent good will result from any system of draining of less than eighteen inches; there is, indeed, a probability that a shallow drain will be productive of more evil than good, by the injury done to the roots of those plants which strike down in the vicinity of the drains. The subject which presents itself next to our consideration is that of manuring, or the restoration of those constituents of the plant which cropping has removed from the earth. A pure virgin soil of average quality requires no manure,—its constituents are intact. It possesses all the elements requisite for vegetable existence, and in proportions very similar to those in which they are found in plants. Referring to the soil of Virginia, we find land which for years was enabled, without the application of a particle of restorative, to carry successive crops of the most exhausting plant—tobacco. In the course of time, however, this soil would not support even a crop of wheat. What expedient did the occupiers of this land resort to, think you, when they found out the true state of things? They did what you cannot do. They removed from the exhausted soil to other virgin land. A few certainly in any locality may effect a removal, but there the whole population left the land to fallow. As their example cannot be followed, you, gentlemen, must resort to other expedients for the restoration of the fertility of the soil. Your first resource—your sheet-anchor—is farmyard manure; this, when in sufficient quantity, will never disappoint you. Not that it contains constituents which other manures do not, but you have it at hand and cheap—important considerations in these times of agricultural difficulties. This source will sometimes fail; then it becomes the farmer to resort for assistance to artificial manures, one of the best of which is guano. It strikes me forcibly, however, and no doubt you have made the same observation, that guano nowadays is not the same as it was—not so valuable. I could say a great deal about the adulteration of guano, much of which has come under my own personal observation; but, as I have already addressed you longer than I intended, I will not now enter upon this. After guano comes night-soil, which, properly prepared, and its excessive moisture removed, is superior to guano, inasmuch as it contains valuable constituents of which even the finest guano is deficient. But in its normal state it could not be brought with advantage from populous districts, owing to high rate of carriage. In Essex and Kent a mixture, consisting one third each of night-soil, road-sweepings, and stable-dung, may be obtained in unlimited quantities, and at a mere nominal price, being delivered at a distance of twenty or thirty miles from the metropolis at from £5 to £10 for a barge of fifty or sixty tons. If you had the same advantages, it is questionable whether it would benefit you. Your land would become too luxuriant, and you might lose that indomitable spirit of industry and enterprise for which the Scottish farmer is so signally distinguished. Having made reference to farmyard manure, I may be excused in again urging upon you the necessity of being most particular about preserving the most essential principles thereof. I have not proceeded thus far north without noticing some middens well washed, and their most valuable constituents, soluble or volatile, carried off by rain or the atmosphere. I have wondered that the owner, having the effluvium so near his habitation, had not sprinkled a quantity of gypsum or sulphuric acid over the offensive heap to fix the volatile ingredients. Blood is an exceedingly valuable manure. I do not think that, weight for weight, there is any that can be compared with it. In rural districts there is a difficulty in obtaining it, but in large manufacturing towns it may be largely obtained. Bones supply several important elements of fertilization; they are, in fact, justly prized as powerful manure. Much has been said of the superiority of neighbouring states as cultivators of the soil; and, previous to the repeal of the corn-laws, we had a dread of competing with Belgium and Holland in the growth of grain. I think, however, that in allowing the exportation of bones they exhibit so much ignorance of the true principles of agricultural science that the British farmers' fears may be perfectly assuaged; and if the Legislature of our own country would pass some stringent law against the waste of the most valuable of all fertilizers — human fœces—we might laugh at anything in the shape of protection, and, in fact, carry on a successful export trade of grain the produce of British skill and industry. Your noble landlord mentioned to me that he had successfully applied the superphosphate of lime dissolved in water by means of the water-cart, or liquid manure-drill, to some turnips, and that these had taken ten days' start of others to which the bruised bones in a powdered state had been applied. As a general principle, the liquid manure-drill cannot be resorted to in this neighbourhood with advantage, for, though the steepness of the hills might not prevent its employment, the upper part of the soil would be deprived of its fair proportion of the manure, and the lower part would receive an excess by the simple law of gravitation. Still the plan suggested by his lordship is worthy of your attentive consideration. Having pointed out the

advantage of tanks on farm-steadings, let me now advise you what to charge them with. It is not simply liquid manure from the stables and cowsheds, but all refuse water from the house, such as soapsuds, &c. It is well known that sewage-water possesses all the requisite elements of fertilization, and that its application has produced the most surprising effects. The property of the Duke of Portland, in the vicinity of Mansfield, has been enhanced to an extent that would stagger belief, had we not the evidence of parliamentary evidence to corroborate the statement. After an outlay of £30 per acre, to bring it into a fit condition for irrigation, a portion of the land is now let at £14 per acre, whilst that which lies at a greater distance from town fetches £5 per acre. And to come near home:—You may find land at Edinburgh—land which previously let for a few shillings—since the application of sewage-water, letting at something like £20 per acre. About the value of common salt as a fertilizer there appear to exist two opinions of a diametrically opposite character. I was waited upon about two years ago by the distinguished French chemist, Dumas, who inquired the estimation salt was held in amongst the farmers of my acquaintance. I could only refer him to parties who tried it. One had reason to entertain the highest opinion of its value, having experienced great benefit to his crops; another condemned its use in unmeasured terms. What a position for agriculture to be in, when so simple a question could not be answered in any other way! Since Professor Dumas' return to France he has written to say he left this country with the question of the agricultural value of salt still undetermined. If salt is good—and I believe it is—its employment is generally too limited. At the same time, there are localities where its application would prove injurious; this, near the coast, is one; further inland it would often prove of essential service. Of lime you may possibly put on your land too much as well as too little; in fact, whatever constituent appears in the soil in excess over the requirements of the plant is injurious. In some parts of England the application of lime is carried to such an extreme that even where the overlying stratum is lime more is added. Looking over a farm in Yorkshire, on one occasion, I saw a heap of lime, and inquired of the farmer the purpose to which he would apply it. His reply was, "To the land." Having noticed the natural superabundance of lime in the soil, I asked if he ever grew oats. He replied, "No, I never can, but I do succeed with barley." Reference to the table will show you that lime exists in a greater extent in barley than in oats. He afterwards admitted that, during those seasons when he was not compelled by his covenant to employ lime, even his crops of barley were better than when he used it. This shows the care with which landed proprietors should have instruments of this character drawn up; for I hold that the tenant, having the rent to pay, should be allowed to discriminate between the employment of certain fertilizers or their rejection; the landlord having the power to refer to competent persons the question of probable injury. The fault, however, does not always lie with the landlord alone. He appoints an agent ignorant of chemical principles, and obstinate in his opinions, who advises the insertion of certain clauses, which the landlord unwittingly permits to appear, to the injury of the tenant and himself. In conclusion, my lord and gentlemen, allow me to thank you, and I do so most heartily, for the close attention you have paid to my observations, and to express a hope that some information of a practical character may be elicited therefrom. At the present moment there are many pressing considerations to render the practice of agriculture one of considerable interest. The most important of these is the existing reduction in the price of agricultural produce. Without presuming to refer to recent legislative enactments in a spirit of partisanship, I will venture to state that ever since I could reason upon the matter I have advocated protective principles. Within the last few months, however, I have been much disposed to think that the removal of protection is not by any means the cause of the depression at present felt on all hands; and, further, I am convinced that the farmer has the power within himself to obviate many of the difficulties by which he is surrounded, without any reference whatever to legislative measures. I have already pointed out the immense advantages to be conferred on vegetable culture by the employment of those matters which are now most suffered to run waste; other appliances, chemical and mechanical, have done much of late years; an extension of these will effect much more; but especially must the farmer avail himself of the opportunities presented to him on every hand for the extension of his knowledge and the application of that knowledge to his practice: this will soon place him above the fear of foreign competition. For, after all, British farmers should bear in mind that the agriculturists of other countries have their own peculiar difficulties, and that, hitherto, they have not been able to import corn at the prices, or in the quantities, we apprehended. As a matter of encouragement, I may call in mind the fact that in America grain has recently been selling at as high prices as in this country; whilst in Belgium, with the solitary exception of the strict, nay, religious, care taken of excrementitious matter, much indifference is paid to the principles of fertilization. Even the article upon which the British farmer depends so much for the successful culture of his turnip crop,—I mean bones,—is exported from the Netherlands to a very serious extent. One alteration in our national economy, and, with the aid of that skill and enterprise which has given to England the great majority of Scottish bailiffs and Scottish gardeners, we bid fair to become totally independent of foreign auxiliaries in the shape of importation of food. Modern fastidiousness has established and perpetuates the waste of the most valuable vegetative food. A species of parochial and other official interference under what appears to me to be the influence of the sixth sense, and which I will denominate epidemicism, or the worst species of epidemic, discovers the germs of disease in every laudable attempt at converting the obnoxious matter into available food for plants, and thus is continued the true source of agricultural difficulty, viz., the high cost and inferior quality of manures. This state of things, however, cannot last long. Already we have thousands of acres of land cultivated by men of high intelligence—men who have spent some fifty years of their lives amidst the din of the loom, the bustle of the shop, or the calculations of the counting-house,—these men, bringing the system and penetration of mercantile habits to their aid, and tilling the ground with signal success, are stimulating the bred-and-born farmer to greater activity of both mind and body.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

ON THE COMPOUNDS OF THE HALOGENS WITH PHOSPHORUS.

By J. H. GLADSTONE, Ph.D.*

During the course of my recent examination of the compounds of phosphorus and nitrogen, I had occasion to prepare considerable quantities of pentachloride of phosphorus; and some observations which I incidentally made upon that substance induced me to undertake a fuller investigation into such combinations of phosphorus with the halogens.

It is well known that if chlorine gas be passed over phosphorus they combine energetically, forming in the first instance a limpid liquid, which is a combination of three atoms of chlorine with one of phosphorus. If the proper amounts of bromine and phosphorus be brought into contact, a similar terbromine is the result. If one part of phosphorus and twelve parts of iodine be mixed, a red, easily fusible, solid results, which appears to be an analogous compound. And, again, if a larger quantity of chlorine, or bromine, or iodine, be employed, crystalline bodies are produced, which are combinations of five atoms of the halogen with one of phosphorus. The same penta-compounds result when an additional quantity of the halogen is added to the substance containing three atoms. I have not succeeded in bringing about similar combinations between cyanogen and phosphorus; in fact, this element may be distilled unchanged in an atmosphere of cyanogen gas.

These compounds form a very distinctly-marked class of bodies. They are neither acid nor basic; and they are resolved by water into the hydracids of the halogens, that is, hydrochloric, hydrobromic, or hydriodic acid, and phosphorus, or phosphoric acid,—according to the number of atoms of the element replaced by oxygen. In these respects they differ from the combinations of sulphur with phosphorus, which have acid properties, are not readily decomposed by water, and are, in fact, strictly analogous to the oxygen compounds.

It is also well known that if the combination between phosphorus and the halogen be made by means of a metallic salt that yields up its electro-negative element readily, or, in other words, if phosphorus be distilled with the chloride, bromide, or iodide of mercury, it is the tercompound that results. In this manner also Davy produced a ter-fluoride. Canadella states that if cyanide of mercury and phosphorus be heated together combination ensues, frequently with explosive violence, and a sublimate is formed resolvable by water into phosphorus and hydrocyanic acids. On repeating his experiment I did obtain a sort of explosion, and a minute quantity of a substance which answered somewhat to the description given. A subsequent attempt, however, was quite unsuccessful. The uncertainty attending the preparation, together with the high probability that poisonous exhalations would arise from such cyanides when exposed to the air, rendered me disinclined to pursue the investigation further.

In order to prepare one of these ter-compounds by means of a metallic salt, it is not necessary that the salt should be capable of decomposition by heat alone. I have prepared terchloride of phosphorus by making use of the chlorides of iron and copper; and doubtless other metallic chlorides might be substituted. Chloride of lead, however, I found not to be decomposed by phosphorus.

The comparative weakness with which the two additional atoms of the pentachloride of phosphorus are held in combination is evident from the ease with which compounds are obtained, where these two atoms of chlorine are substituted by sulphur and oxygen, as already made known by Serullas and Wurtz; but the readiness with which the penta-compounds are reduced to the ter-compounds has never, I think, been pointed out. If the chloride, bromide, or iodide of phosphorus, containing five atoms of the halogen, be heated in contact with fresh phosphorus, chemical action is instituted, and the whole is reduced to the compound containing three atoms. With the bromide the application of extraneous heat is quite unnecessary: with the iodide the reduction will proceed even to the formation of a compound containing a much smaller amount of iodine, but of a totally different character to the bodies now under consideration. Upon this may be founded a good method for obtaining the terchloride and terbromide, as their freedom from admixture with the higher combination can then be depended upon: sufficient phosphorus must be employed to reduce the whole, and the liquid may be distilled of perfect purity. Similarly it has been heretofore observed that the pentachloride of phosphorus is reduced to the terchloride by the action of phosphuretted

* Communicated by the author to "The Philosophical Magazine."

hydrogen; and this again is completely decomposed if the current of gas be continued. If the yellow crystals of pentabromide be subjected to the same treatment, a liquid compound is instantly produced, whilst acid fumes are evolved; and the long-continued action of the phosphuretted hydrogen gas causes the entire disappearance of the liquid, yellow phosphorus being left in its place. The reaction is evidently the same as in the case of the chloride, and may be expressed by the two formulæ:—

$$3PBr_5 + PH_3 = 4PBr_3 + 3HBr,$$

and

$$PBr_3 + PH_3 = 2P + 3HBr.$$

Although phosphuretted hydrogen is thus capable of reducing these combinations of phosphorus with the halogens, pure hydrogen gas has not the slightest effect upon the pentachloride of phosphorus even at the subliming point of that substance; nor does it produce any alteration in the pentabromide, at least not at the ordinary temperature. Heat alone, however, will effect the reduction of this latter compound, provided a stream of dry air be passed over it. The experiment is conveniently made in a water-bath at 100° C., when bromine passes off, and the liquid terbromide remains. The peculiar reddening of the pentabromide during sublimation, first observed by Balard, is in all probability owing to this cause. When the penta-compound fuses, it is partially decomposed into terbromide of phosphorus and free bromine, which colours the liquid red; he two rise in vapour together, thus producing a red gas; and, when they reach a sufficiently cool portion of the vessel, recombine to form the lemon-yellow crystals of the penta-compound. It is not intended by this explanation to deny that pentabromide of phosphorus may be capable of volatilization without being decomposed. In a similar manner the higher compound of iodine and phosphorus may be reduced by the aid of heat alone. The pentachloride, on the contrary, resists the decomposing action of heat.

The relative force of affinity between phosphorus and the three halogens to which my attention has been more especially directed is in the order—chlorine, bromine, iodine. Thus, teriodide of phosphorus is decomposed by both chlorine and bromine; the terbromide by chlorine, but not by iodine; whilst the terchloride is not decomposed by either of the other elements. The same is indicated by the fact that terbromide of phosphorus distilled with chloride of mercury yields terchloride of phosphorus, and bromide of mercury which remains in the retort. None of these three ter-compounds is directly acted upon by oxygen gas; the terchloride of phosphorus is unaffected by sulphur at any temperature; the terbromide also appears to enter into no definite combination, yet, if the oxygen or sulphur be united with hydrogen, double decomposition ensues. Water, as is well known, resolves these ter-compounds into the hydracids and phosphorus acid. Hydrosulphuric acid, as observed by Serullas, resolves terchloride of phosphorus into hydrochloric acid and tersulphide of phosphorus. A similar action takes place with the terbromide, which may be expressed by the formula:—

$$PBr_3 + 3HS = PS_3 + 3HBr.$$

When we consider the action of these non-metallic elements and their hydracids upon the penta-compounds, we are again reminded of the comparative feebleness with which the two additional atoms are combined. Pentachloride of phosphorus, it is true, is unaffected by bromine, and the action of iodine upon it did not appear to me well defined; but pentabromide of phosphorus, carefully prepared so as to avoid excess of bromine, when brought into contact with iodine at the ordinary temperature, quickly ran down into a red liquid, and terbromide was found in the vessel. Very little iodine is required to effect this reaction; and, since the compound IBr_5 is known to be readily formed, the decomposition in all probability may be thus expressed:—

$$5PBr_5 + 2I = 5PBr_3 + 2IBr_5.$$

The action of sulphur upon these penta-compounds is remarkable. If it be mixed with the pentachloride of phosphorus, and the whole fused together, combination ensues; but this is not a case of reduction; and the new products—a liquid and a crystalline body—require a more lengthy consideration than can be given them in this paper. Again, if pentabromide of phosphorus be mixed with sulphur, no action takes place in the cold; but, upon gently raising the temperature, combination is instituted; the odour of bromide of sulphur is perceptible; and a liquid is produced, which appears to consist, partially at least, of a compound that will be presently described.

We have now to consider the manner in which these penta-compounds of the halogens with phosphorus frequently part with the two additional atoms when treated with hydrogen compounds. Hydriodic acid reduces the pentachloride of phosphorus to the terchloride, a fact first remarked by Serullas; yet I did not find the same occur with the pentabromide; nor was the pentachloride itself affected by a stream of hydrobromic acid,* even when heated. The proto-compounds of oxygen and sulphur with hydrogen act somewhat differently: the hydrogen enters into combination with the two atoms of the halogen that are more easily removable, and leaves the oxygen or sulphur in combination with the phosphorus compound. These substances in the chlorine series are the oxychloride of phosphorus described by Wurtz, having the composition $PCl_3 O_2$, and the sulphochloride of phosphorus discovered by Serullas, bearing the formula $P Cl_3 S_2$. In order to produce this oxygen compound, the action of the water must be moderated, or a secondary transformation into phosphoric and hydrochloric acids will take place. This may be effected either by throwing the white crystals of pentachloride of phosphorus into water, when they are instantly converted into the liquid oxychloride, and immediately afterwards drawing off the supernatant fluid; or, with greater ease, by exposing the solid chloride to the moisture of the atmosphere until the conversion is complete, hydrochloric acid being constantly evolved. A compound strictly analogous to this may be obtained from the pentabromide of phosphorus by either of the two processes. The latter is of course preferable.

Oxybromide of Phosphorus.—When pentabromide of phosphorus is entirely decomposed by a moist atmosphere, there remains in the vessel a reddish liquid of a sticky consistency. This must be gently heated to expel hydrobromic acid, of which it contains a large quantity; and then, upon distillation at about 180° C., a heavy vapour passes over, condensing into a colourless liquid of high specific gravity. It does not mix with water, but is slowly resolved by it into phosphoric acid and hydrobromic acid. It is soluble in oil of turpentine and in ether, and is also dissolved by strong sulphuric acid, from which it may be precipitated by water, unchanged, but soon suffering, of course, a secondary decomposition. Nitric acid destroys it violently with evolution of bromine. Bromine added to it reproduces momentarily the yellow crystals of pentabromide; but the final result is a liquid, which, upon the application of heat, evolves bromine, and apparently leaves the original substance behind unaltered. Chlorine displaces the bromine in this compound, red vapours being immediately evolved when it is treated with that gas.

The analysis of this substance was effected by decomposing it in water, and precipitating the hydrobromic and phosphoric acids thus produced in the usual manner. The results, as given below, fully confirmed the expectation that this new liquid was the oxybromide of phosphorus, having the composition $P Br_3 O_2$.

0.6245 grm. of substance yielded 1.227 grm. of bromide of silver, and 0.1514 grm. of phosphoric acid.

0.811 grm. of another preparation yielded 1.605 grm. of bromide of silver.

Or, calculated to 100 parts:—

	By Experiment.		By Calculation from $P Br_3 O_2$.
Phosphorus	10.77	..	11.29
Bromine ..	82.50	83.11	83.06
Oxygen ..	..	..	5.65

The production of this oxybromide of phosphorus will be expressed by the equation:—

$$P Br_5 + 2HO = P Br_3 O_2 + 2HBr.$$

I have not succeeded in accurately determining the boiling-point of the liquid under consideration. It appears to vary between 170° C. and perhaps thirty degrees higher. Kopp finds that the substitution of three atoms of chlorine by three atoms of bromine in a compound causes an elevation in its boiling-point of 96° C. Thus, the terchloride of phosphorus boils at 78° C.; the terbromide at 175° C. (Pierre), or 174° C., according to my own observations. Now, as oxychloride of phosphorus boils at 110° C., this would give us the boiling-point of oxybromide of phosphorus 206° C.; but experiment certainly does not indicate it as so high.

I may here remark that, in the decomposition of this oxybromide by water, there is usually formed a small quantity of a brown resinous-looking matter, not acted upon by water, nor soluble either in potash or nitric acid. It has a very characteristic odour. I have never obtained it in sufficient quantity for thorough examination. This readily accounts for the slight loss in the first analysis recorded above.

[*To be continued.*]

* Hydriodic or hydrobromic acid in a gaseous condition may be conveniently prepared by the action of iodine or bromine on hyposulphite of soda moistened with a little water. The reaction will be evident from the equation:—

$$NaO, S_2 O_2 + HO + Br = NaO, SO_3 + S + HBr.$$

In the case of iodine it is necessary to apply heat.

ON A PECULIAR FIBRE OF COTTON WHICH IS INCAPABLE OF BEING DYED.

By WALTER CRUM, Esq., F.R.S.,
*Vice-President of the Philosophical Society of Glasgow.**

In the month of May last Mr. Thomson, of Primrose, received from M. Daniel Kœchlin, of Mülhausen, some specimens of a purple ground printed calico, each of them containing a portion of cotton which was white, although subjected to the same treatment by which the rest of the cloth, and even the threads which crossed the white one, were uniformly dyed. The white part of the thread was usually thicker than the rest, and little more than a quarter of an inch long. The whole fabric had been thoroughly bleached before printing, so that it contained no grease or other impurity that could resist the colouring matter.

White specks like these are not unknown or undreaded among the printers of calicoes in this country. M. Kœchlin mentions that the cotton of which they are formed is known by the name of coton mort, and here also it is called dead cotton. M. Kœchlin has been the first, I believe, to suggest that it may consist of unripe cotton, and that its fibre may be solid, wanting the hollow of the more perfect fibre. He adds that, if such should prove to be the case, its behaviour with colouring matters may affect materially the question of the mechanical or chemical nature of the union of cotton with its dye. Mr. Thomson did me the honour to transmit me the specimens for examination.

The ordinary cotton fibre, it will be remembered, is described by Mr. Thomson in the memoir where its form was first made known,†

* From the Proceedings of the Philosophical Society of Glasgow, 1848-49, and read before that society April 25, 1849.

† "Annals of Philosophy" for June, 1834. Lately reprinted in "The Classical Museum,"

as a tube, originally cylindrical, but which collapses in drying. It has then the appearance of two small tubes joined together, so that a transverse section of the filament resembles in some degree a figure of 8. Until full maturity the cylinder is distended with water, in which bubbles of air are often distinguishable.

On placing a few of the fibres of the coton mort under the microscope, I found them to consist of very thin and remarkably transparent blades, some of which are marked or spotted, while others are so clear as to be almost invisible except at the edges. These fibres are readily distinguished from those of ordinary cotton by their perfect flatness, without the vestige of a cavity, even at the sides, and by their uniform as well as great transparency. They are often broader, too, than the usual fibre, and they show numerous folds, both longitudinal and transverse; but they are never twisted into the corkscrew form of the ordinary fibre.

It occurred to me that cotton of this description might be detected among the wool as it is imported. I searched accordingly for any portions that had a different appearance from the rest; and, having collected and examined them, I found one sort whose filaments had exactly the appearance under the microscope of the coton mort in the pattern of M. Kœchlin. It occurs in the form of a small matted tuft of a shining silky lustre, and usually contains in its centre the fragment of a seed, or perhaps an abortive seed. It consists of short fibres having little tenacity. Specimens of it are found in abundance among the motes or hard portions, called droppings, rejected by the picking-machine in the preparation for spinning. Small tufts of it, however, do occasionally pass the sifting process of the picking-machine; and then, their fibres being too short to be teazed out in the carding-engine, or drawn into threads in the subsequent operations of cotton-spinning, remain as minute lumps or knots upon the threads of better wool.

Although the microscopic appearance of the fibre in question is that of a flat single blade, the cellular character of the tissue scarcely admits of such a formation. We must rather suppose that, like the healthy unripe cotton fibre, it was originally an elongated cell or tube filled with liquid; that the seed around which it began to grow had died soon after its formation, while the fibres which clothed it were yet soft and pliable; and that the flattening and perhaps growing together of the sides of the tube was occasioned by the pressure from the increasing crop of cotton attached to the numerous other seeds confined in the same pod.

To explain the bearing of this peculiar structure upon the question whether cotton wool and colouring matters form together a true chemical compound, or are held together by a merely mechanical power, I must quote a passage from a memoir on this subject which I read to the Philosophical Society six years ago, and refer to the memoir itself for additional illustrations :—

"In many of the operations of dyeing and calico-printing the mineral basis of the colour is applied to the cotton in a state of solution in a volatile acid. This solution is allowed to dry upon the cloth, and in a short time the salt is decomposed, just as it would be, in similar circumstances, without the intervention of cotton. During the decomposition of the salt its acid escapes, and the metallic oxide adheres to the fibre so firmly as to resist the action of water applied to it with some violence. In this way does acetate of alumina act; and, nearly in the same manner, acetate of iron. The action here can only be mechanical on the part of the cotton; and the adherence, as I shall endeavour to show, confined to the interior of the tubes of which wools consist, or of the invisible passages which lead to it. The metallic oxide permeates these tubes in a state of solution; and it is only when its salt is there decomposed, and the oxide precipitated and reduced to an insoluble powder, that it is prevented from returning through the fine filter in which it is then enclosed.

"When the piece of cotton, which, in this view, consists of bags lined inside with a metallic oxide, is subsequently dyed with madder or logwood, and becomes thereby red or black, the action is purely one of chemical attraction between the mineral in the cloth and the organic matter in the dye-vessel, which, together, form the red or black compound that results; and there is no peculiarity of a chemical nature, from the mineral constituent being previously connected with the cotton."

To produce the purple dye of M. Kœchlin's pattern, the cloth has first to be impregnated with iron. For this purpose it is made to imbibe a weak solution of proto-acetate of iron, and afterwards dried. By exposure to the air for some days the salt is decomposed. Its acetic acid evaporates, and the oxide of iron, then become peroxide, remains in the fibre. The cloth is afterwards subjected to severe washings in hot and cold water, but its iron is not removed; and the question is, how is it retained in connection with the cotton? Mechanically, as I maintain, and probably in the interior of its hollow fibre, which it entered in a state of solution, and within which it was precipitated. Others, as I have already stated, are of opinion, after Bergman, that the combination is a chemical one; and so fully is that view carried out by my friend Professor Runge, of Oranienburg, in his ingenious and excellent work on the "Chemistry of Dyeing,"* that he assumes coloured cottons to be combinations of what he calls cottonic acid with the various bases, in definite, and even in multiple, proportions. Thus a very pale shade of buff from oxide of iron is called percottonate of iron; another is called bicottonate of iron; and still deeper shades, cottonate and basic cottonate of iron.

But the new fibre, by the same treatment, is incapable of retaining the iron mordant, and yet both fibres have the same chemical composition and the same ultimate structure. The only difference is, that one is shaped into tubes or bags capable of holding all matters which are insoluble in water, that is, all bodies which can be caught upon a filter, while the other is possessed of no such enclosure.

I take this opportunity, in reply to a review of my first memoir on this subject, by M. Persoz, in his remarkable work, "Traité de l'Impression des Tissus," of explaining that I attribute to an attraction of surface those cases of dyeing where pure cotton, by mere immersion, is enabled to decompose the solid matters in solution, and to withdraw them from the solvent. Such is the case with the solution of deoxidized indigo in lime, with the plumbite of lime, with the various salts of tin, and many other solutions. Cotton, as I have stated, acts in these cases like charcoal and other porous bodies, and I have seen no reason to confine the attraction in question to the internal surface of the cotton fibre.

But I have not ranked the aluminous mordant among the class of bodies so attracted; because cotton, when immersed in a solution of acetate of alumina, has not the power of separating its base. That solution must be applied to cotton and dried in it; and then the alumina only adheres, or loses the power of being washed away, in proportion as the acetic acid is removed by evaporation. I could see here no chemical decomposition effected by the cotton wool, for the same salt may be decomposed by evaporation in a glass vessel. In this case I have represented the alumina as being held in the interior of the fibre, just as sand may be held in a bag whose interstices are too narrow to allow its particles to pass.

M. Persoz has remarked, however, that by evaporating a solution of acetate of alumina in a glass vessel we do not so thoroughly decompose it as by drying the same substance upon calico. This I also have observed; and, although I have been accustomed to ascribe the difference to the more extensive division and exposure of the salt upon cotton, I have no proof, and shall not deny, that the presence of cotton at a particular stage of the evaporation may accelerate the decomposition of the salt, and that its fibres may thus attract a portion of alumina over their whole surface. If this modification of the view I had given be correct, the action of the coton mort proves, at least, that colouring matter adhering outside is not so permanent as that which is held within the fibre of the mature cotton.

Neither view gives any countenance to the chemical theory. Porous bodies are well known to attract, and even to decompose, without chemically combining with the substances they precipitate. Accordingly none of the oxides are changed either in colour or in chemical character by their union with cotton. The hydrated oxide of copper, for example, precipitated upon calico, becomes carbonate, or arsenite, when exposed to carbonic or arsenious acid. The protoxide of iron changes speedily in the air into the red sesquioxide, and that again may be converted into prussian blue, or into a black or purple lake—every new compound, if it only be insoluble, adhering firmly to the wool.

COMPARATIVE STUDY OF THE AURIFEROUS SANDS OF CALIFORNIA, NEW GRANADA, AND OF THE OURAL.

By M. DUFRENOY.

[*Concluded from page* 223.]

SANDS OF THE OURAL.

I have examined two varieties of sand from the Oural, which had been sent to M. Becquerel by the Russian Government, of which he sent samples to the Museum of Natural History; the other collected by M. Le Play on the spot.

The first is, doubtless, a less concentrated product of washing than the second; it contains only ten per cent. of black oxide of iron. Most of the fragments composing it are quartzy.

The second contains 22.12 of magnetic oxide of iron.

M. Le Play, attached to M. Demidoff's scientific expedition of the Oural, has communicated to me some valuable information concerning the washing of the sand, which will enable me farther on to hazard some conjectures on the richness of the Californian sand. This engineer made numerous experiments, to prove the richness of the auriferous washings of the Oural; he ascertained that the richest washings gave 0.000.0008, and that they treated the sands which contained only 0.000.0001 of gold.

The sand sent to me by M. Le Play belongs to the first kind; it had been concentrated in such a way that 100 grains of washed sand resulted from 3,200 grammes of crude sand. It contained about 0.22256 of gold.

Quartz, which was very abundant in M. Becquerel's sample, was comparatively scarce in this. It belonged to three varieties, namely, colourless hyaline quartz, amethyst quartz, and smoky quartz. The most abundant mineral appears to be the titaniferous oxide of iron: it is black, with a brilliant and rather resinous lustre; the grains are generally rounded and without form, so that I could not distinguish in it the specular iron. I think, moreover, that if this oxide of iron exists in these sands it is at any rate very rare, for I could not isolate grains giving the red powder. I observed elongated grains, having a coarse prismatic form, which reminded me of mengite, a mineral very abundant in the mountains of the Ural.

Transparent grains of a greenish yellow, with a milky hue, were perceived, which appeared to belong to eymophane; I likewise saw a few crystals of white zircon, whose forms were appreciable, although the angles were very much blunted: the faces of the octahedron a' greatly predominated, and its crystals were depressed.

No. 20; and in "Liebig's Annalen" for Jan., 1849.

* "Farbenchemie." 2 vols. Berlin, 1832 and 1845.

The grains of this variety of sand of the Ural are generally very round, and bear, consequently, traces of a long friction, and, perhaps, of removal from a great distance. Their dimensions are generally very uniform, which enabled me to count a certain number of them. The relative proportions which this single estimation gave me are as follow :—

Magnetic oxide of iron	23
Titaniferous oxide of iron (mengite), &c.	50
Cymophane	10
Hyaline quartz, of different varieties ...	14
Zircon	3
	100

There exists, besides, iron pyrites and copper pyrites. I found the specific gravity of the sands of the Ural to be 4.53, a little higher than that of the Californian sands, which would allow them to be richer in magnetic oxide of iron and specular iron than the latter.

The composition of the sands of the Ural presents considerable differences from those of America; the latter contained fifty-nine per cent. of magnetic oxide of iron, and the second twenty-three; they contained, on the contrary, fifty per cent. of titaniferous iron, whilst the other contain only fifteen or sixteen per cent.; but the most remarkable difference consists in the presence of cymophane to the amount of at least ten per cent.

Zircon is also contained in it, but in very small quantity; quartz, which is one of the essential elements of every crystalline rock, is found in it in equal abundance. The proportion observed in the concentrated auriferous sand is not nearly equal to that of the crude alluvion; but the specific gravity of the quartz being only 2.7, whilst that of the magnetic oxide is 5.09, that of the zircon 4.50, and that of the cymophane 3.68, the greater part of the quartz must be removed at an early stage of the washing.

SANDS OF THE RHINE.

I have examined an auriferous sand from the valley of the Rhine, which was presented to the Musuem of Natural History by M. Ménard de la Groye. The exact place from which this sand was obtained was not stated, nor was its degree of concentration known; it must be very feeble, judging, at least, from the proportion of oxide of iron separated from it by means of the magnet, which did not amount to quite two per cent. The remaining sand contains, also, shining black grains, analogous to the titaniferous oxide of iron; the proportion of it is small. I did not calculate it, but I do not think that it exceeded three or four per cent. The quartz is not the dominant part, but almost the absolute element, and it may be estimated at not less than ninety per cent.; it is constantly hyaline, but various in colour, colourless, smoky, deep yellow, and rose topaz; this last variety is abundant. In the midst of this multitude of grains of quartz some crystals of white zircon are distinguished; their angles are blunted, whilst the quartz is in angular fragments. The remarkable difference between the condition of the crystals of zircon and of the grains of quartz might, perhaps, indicate the mixture of the alluvion of different dates.

I did not observe spinel in any of the auriferous sands which I examined. Is this absence fortuitous, or, on the contrary, the result of a general cause? I should be inclined to adopt the latter opinion. I found spinel in great abundance in the stanniferous sands of Pyriac. I have also seen it in the tin washings in Cornwall; perhaps it might be concluded from this that this mineral belongs to more ancient crystalline rocks than those which contain the beds of gold.

I have announced that the accurate knowledge of the richness in gold of the sands of the Ural would enable us to form a conjecture as to that of those of California; indeed, the density of these sands being very nearly 4.37 and 4.53, it may be admitted that the operation of washing has concentrated the sands in nearly equal proportions. Now, the washed sand of the Ural contains 0.00256 of gold, the assay of the washed sand of California gave 0.0029 for its richness; the latter, although superior, is so by very little. We have also some information verifying, in some measure, this hypothesis: Russia produced in 1847 a quantity of gold, valued at 77 millions of francs (about £3,080,000); the number of workmen employed in washing in that empire was about 50,000. From documents published concerning California, in the American and English journals, it would appear that the production of gold has amounted to four or five millions of dollars, that is from £800,000 to £1,000,000, and the number of workers to from 15,000 to 16,000. Now, this is as nearly the third of 77 millions as 16,000 is that of 50,000 workmen; thus the same number of workmen produce about the same quantity of gold; there is, therefore, an analogy between the richness of the washed sands of the Ural and California, and a similar production by the workman; it is, therefore, natural to think that the auriferous diluvium of California is presented, with respect to richness, in analogous condition to other gold washings.

The important discovery of the gold workings of California may, at first, give great profits; either because the first seekers have fallen on extremely rich places, or from any other fortuitous cause; but an average of products will very soon be established, which will give to this speculation its real value.

The products of the Russian mines which are officially known enable us to estimate, approximately, how much each workman should obtain per day. It is sufficient to divide the number 77,000,000 by 50,000. We find by this calculation that each workman annually produces a quantity of gold corresponding to 1,540 francs (or about £62). Admitting, on account of local circumstances, that the workmen labour only 200 days per annum, the average daily produce of a workman is 7 francs and 70 centimes per day (or about 6s.).

When the working of gold mines is compared with that of iron, it is remarked that the advantage is on the side of the latter. We find, indeed, in the "Comptes Rendus des Ingénieurs des Mines," for 1847, that the production of cast iron and iron amounted, in France, for that year to about 191,000,000 francs (£7,640,000), and that the number of workmen employed in the different works of the forges is about 33,000.* The value created by each workman in that year was therefore 5,788 francs (£231 10s.). The frequent stoppages which occur in ironworks, either from the scarcity of wood or the temporary supension of the motive powers, lead us to believe that each workman laboured at most 250 days in the year.

The daily produce would be, under this supposition, 23 francs 17 centimes (about 18s. 8d.) per day; admitting 300 days per year, it would be 19 francs 25 centimes (or 15s. 5d.). In order to establish an accurate comparison between the advantages of working gold and those of working iron, it would be necessary to introduce into it the capital employed in each of those operations. We do not possess sufficiently complete documents for making this calculation; but we know that the working of iron requires much greater outlay in material and fuel than gold-washing does. However, it appears to me certain that the value created by each ironsmith is at least equal to that produced by the gold-seeker.

The foregoing estimations, however erroneous they may be supposed, appear to me to make it certain that the gold-working of California presents the same conditions as the workings previously well known.

The advantages are analogous, and they will depend entirely on the price of hand labour; whilst in the working of the auriferous sands the expenses consist almost exclusively in the transport and washing of the earths; at all events, these could not be extremely considerable, since the crude product for each workman could not be estimated at more than 9 or 10 francs per day. The discovery of gold in California will not, therefore, produce the revolution which has been supposed in mineral industry; but it will be to this new state of the American Union a source of wealth and civilization.

* Number of workmen employed in the production of iron ("Comptes Rendus des Ingénieurs des Mines"), 1847 :—

Employed in the extraction of the ores...	15,000
Employed in working the furnaces	5,000
Employed in the forges	13,000
	33,000

ON THE PRODUCTION OF ETHERS BY THE ACTION OF POTASH UPON THE BALSAMS.

By Professor E. A. SHARLING,
of Copenhagen.*

On the 19th of January, 1849, the author communicated to the Royal Danish Academy of Sciences a preliminary statement of some experiments made in order to produce ethers by acting with potash on various natural balsams. After having noticed the earlier investigations on Peruvian balsam, he observes that the formula given by Fremy for the composition of cinnamcine, $C^{54}H^{26}O^{8}$, may be looked upon as $2(C^{16}H^{7}O^{4}) + C^{22}H^{12}O^{4}$, of which the first member represents the formula for cinnameine given by Plantamour, and the second member that for cinnamic ether, which the latter chemist produced from Peruvian balsam. Plantamour, however, having used alcohol in his investigations, doubts might arise whether this had not occasioned the formation of the cinnamic ether. The author submitted 1 part of Peruvian balsam and 2 or 3 parts of solution of potash, of the specific gravity 1.3, to distillation, after the mixture had been left for twenty-four hours. The product consisted of water and two oily bodies, the one lighter the other heavier than water. By drying and redistillation, the heavier liquid was obtained perfectly transparent, of high refractive power, of specific gravity 1.03, and with a boiling-point of 401° F. Immediately after the distillation the smell was faint; but after having stood for a while it became aromatic, like that of cinnamic ether.

Immersed in a refrigerating mixture of snow and rock-salt, the whole remained liquid at 5°F. The oily liquid, of less specific gravity, boiled at about 256°; its specific gravity was less than that of water; the smell not unlike aniseed; the taste sweetish, aromatic. Cooled to 5° F., the greatest part congealed. Both these liquids are altered by distillation; for even when heated in an oil-bath they assume a light wax-yellow colour before they begin to boil. As both these liquids thus offered great resemblance to cinnamic ether and peruvine, the author tried to ascertain their identity with these substances by treating them with hydrate of potash and sulphuret of carbon. Although the discoverer of xanthogenic acid, the late Prof. Zeise, remarks that ether and sulphuret of carbon with hydrate of potash do not give xanthogenate of potash, yet it was presumed that this salt might be produced by treating compound species of ether with hydrate of potash and sulphuret of carbon. As this supposition has been fully confirmed with different kinds of ether, for instance with acetic ether, the author mixed separately both the liquids produced by Peruvian balsam with powdered hydrate of potash and sulphuret of carbon. In both these experiments the mixtures congealed; and when samples of the saline mass were dried between paper, and then dissolved in water and tested with salts of copper and lead, they furnished yellow xanthogenate of copper and white xanthogenate of lead. Hence there can be no doubt that the liquid of higher specific gravity contains cinnamic ether, obtained for the first time without any addition of alcohol. How far

* Communicated by the author to "The Chemical Gazette."

the liquid of less specific gravity is peruvine, or a mixture of peruvine and cinnamic ether, the author hopes to be enabled to state more fully in a subsequent communication. By distilling the solution of potash, which had been separated from the cinnameine, only traces of an oily liquid were obtained; the rest of the distallate appeared to be water. Hence it is evident that even at the ordinary temperature, and by the influence of a solution of potash, the combination, which at a suitable temperature is converted into a species of ether, is decomposed. By distilling Peruvian balsam with water, no oil or ether, as is known, is produced. Since this possibly might arise from the boiling-point of cinnamic ether lying too high, the author distilled a portion of Peruvian balsam with a solution of mineral salt, and a smaller portion of balsam with a concentrated solution of chloride of zinc. The last distillation was performed by dropping the balsam gradually into the boiling saline solution. By this process, besides water, some cinnamic acid, and a very little quantity of two liquid, oily, brownish bodies, the one of greater and the other of less specific gravity than water, were obtained. Both had an empyreumatic odour; and when boiled with water a quantity of crystals of cinnamic acid were obtained by cooling. The author could discover no trace of cinnamic ether in this distillate. By subjecting Peruvian balsam to dry distillation, several oily liquids were obtained, containing a great quantity of cinnamic acid, as also water. The cinnamic acid crystallized on cooling, and was collected on a filter; the liquid that had passed through, after it had been dried over chloride of calcium and redistilled, was treated with powdered hydrate of potash and sulphuret of carbon. No traces of xanthogenic acid could be detected in this mixture.

A portion of Peruvian balsam was next operated upon with a solution of carbonate of soda. The watery solution obtained behaved like a solution of cinnamate of soda. The remaining substance was dried, dry carbonate of soda added to it, and the mixture subjected to destructive distillation. The product resembled in appearance the products from the dry distillation of the Peruvian balsam; but in this traces of xanthogenic acid were found by suitable treatment. From these experiments, therefore, it is not to be concluded that cinnamic ether pre-exists in the balsam, but that it is most likely formed by the action of strong bases.

E. Simon's investigation on liquid storax has made us acquainted with a body which he calls styracone. The author found that on treating liquid storax in the same manner as he had treated Peruvian balsam he immediately obtained a distillate, from which, after standing for a while, a body separated, which possessed all the properties assigned by Simon to styracone. Moreover, it easily dissolved in alcohol of 0.851 spec. grav. By treating the styracone with powdered hydrate of potash and sulphuret of carbon, xanthogenate of potash was formed amongst other products. Hence it is supposed that the styracone constitutes a compound ether, and the author intends investigating it more minutely. From want of styrole, he examined how benzole would act with hydrate of potash and sulphuret of carbon. No xanthogenate of potash was produced. Balsam of copaiva was next treated with hydrate of potash, and then distilled. A considerable quantity of oil, which floated on the distilled water, was immediately obtained. When the water had been poured back and distilled a second time, the quantity of oil collected constituted about 5 oz., and the distilled water about four times as much. A pound of balsam and a pound and a half of solution of potash (spec. grav. 1.25) had been used. The oil did not appear to differ from that of balsam of copaiva which occurs in trade; but, on treating these oils with hydrate of potash and sulphuret of carbon, no formation of xanthogenate of potash could be perceived. Copaivic acid, however, not being of a volatile nature, the author has not given up the hope of producing an ether by the action of a solution of potash from this balsam by a somewhat altered process. By treating Venetian turpentine in a similar manner an oily liquid was obtained, which, when dried over chloride of calcium or lime, did not appear to be acted upon by powdered hydrate of potash. For several hours after the addition of the potash the colour of the liquid remained unaltered, and exhibited no change of temperature. On adding sulphuret of carbon, a white saline mass was formed after some time, which gradually caused the whole mixture to congeal into a jelly. After twenty-four hours this jelly was thrown upon a filter; and, when the greater part of the liquid which the mass contained had run off, the residue was most carefully pressed between paper. A part of the saline mass thus obtained was dissolved after being dried; another portion was shaken with ether, in order to remove all adherent oil and resin. The ether was separated by filtration, and the saline mass, after being dried, was likewise dissolved in water. Both these solutions immediately produced brown precipitates with bichloride of copper, but which after some time became yellow.

With nitrate of lead, whitish-yellow precipitates were produced; and, with several other solutions of salts, similar reactions to those produced by xanthogenic acid, except that all the precipitates had in general a somewhat darker colour. This circumstance led to the supposition that an ether had been formed by the action o the potash on the Venetian turpentine. The boiling-point of the distillate was about 307° F.; its specific gravity 0.87; the solubility in alcohol of 0.823 spec. grav. was identical with that of common oil of turpentine.

These properties agree so nearly with those of common turpentine oil, that the supposition of the liquid being a species of ether was abandoned; whereas it was presumed that, if Venetian turpentine was distilled with water, the oil obtained would exhibit the same relations to hydrate of potash and sulphuret of carbon as the above-mentioned liquid. Experiment gave an affirmative answer. Common oil of turpentine, recently distilled and well freed from water, was treated as above. The results, upon the whole, were the same; consequently it is possible to produce, by the action of hydrate of potash and sulphuret of carbon, from pure turpentine oil, a combination possessing great resemblance to xanthogenic acid. But in order to form this substance it is absolutely necessary to have well-fused hydrate of potash; because in the state in which it is often met with in commerce it contains too much water. The whole of the turpentine oil cannot be decomposed by the sulphuret of carbon and hydrate of potash. The same appears to occur in this decomposition as in the production of terpine; a part only of the turpentine oil enters into the new combination.

The author observed, that though it is asserted that all pure turpentine oil consists only of $C^{10}H^8$, and that the boiling-point and the specific gravity are alike, yet the oil from Venetian turpentine appears in several respects to differ from the oil of common turpentine. Thus the last-mentioned oil is speedily coloured by the hydrate of potash, which is not the case with the oil of Venetian turpentine. The latter oil polarizes the light to the left; but only a rotation of 25° is required to produce the violet colour. The same is the case with a saturated solution of muriate of dadyle in alcohol when the dadyle has been prepared from Venetian turpentine.

Common turpentine oil also polarizes the light to the left; but to produce the violet light a rotation of 70° is required. This also happens both with a saturated alcoholic solution of muriate of dadyle prepared from common turpentine oil, and the liquid part of that turpentine oil from which the compound resembling xanthogenate of potash had been produced. The longer the turpentine oil has been kept, the stronger is it acted upon by the hydrate of potash. It is owing to this circumstance that at times it produces an increase of temperature of more than 108° F.; then forms a clear brown gelatinous mass, which appears in a great measure to prevent the production of the compound resembling xanthogenate of potash. Even when common turpentine, recently rectified and dried over lime, is employed for the preparation of this salt, a much darker product is generally obtained than with oil from Venetian turpentine. By allowing the saline mass, which in general contains potash and sulphuret of potassium, to remain exposed to the air, the substance becomes clearer, and the precipitate produced by sulphate of copper becomes yellow much sooner.

The author has not yet succeeded in obtaining the compound resembling xanthogenate of potash from terpine; whether it can be procured from terpinole he has hitherto had no opportunity of ascertaining. The author intends making similar experiments with several other essential oils, the results of which will be communicated hereafter.

RESEARCHES ON THE THEORY OF THE PRINCIPAL PHENOMENA OF PHOTOGRAPHY IN THE DAGUERREOTYPE PROCESS.

By A. CLAUDET.*

Although the daguerreotype process has during the last ten years been investigated by a great number of philosophers, and brought to a considerable degree of perfection by a still greater number of practitioners, it may appear surprising that the principal phenomena upon which this new art is founded are still enveloped in a mysterious darkness.

My constant endeavour has been to explain them, and at the two last meetings of the British Association I have had the honour of communicating the results of some of my researches.

The phenomena which have not yet been satisfactorily explained, and of which I shall have to treat in the present paper, are those referring to the following points:—

1. What is the action of light on the sensitive coating?
2. How does the mercurial vapour produce the daguerreotype image?
3. Which are the particular rays of light that impart to the chemical surface the affinity for mercury?
4. What is the cause of the difference in achromatic lenses between the visual and photogenic foci? why do they constantly vary?
5. What are the means of measuring photogenic rays, and of finding the true focus at which they produce the image?

At the last meeting of the British Association, which took place at Swansea, I announced that the decomposition of the chemical surface of the daguerreotype plate by the action of certain rays of light produced on that surface a white precipitate, insoluble in the hyposulphite of soda, which, when examined by the microscope, had the appearance of crystals reflecting light, and which, when seen by the naked eye, were the cause of a positive daguerreotype image.

This fact had not been observed before. The opinion of Daguerre himself and other writers was, that the action of light on the iodide of silver had only the effect of darkening the surface, and consequently of producing a negative image. But it escaped them that, under the darkened iodide of silver, another action could take place after a continued exposure to light, and that the hyposulphite of soda washing could disclose a positive image. I have proved this unexpected fact in obtaining, by the action of light only, and without mercury, images having the same appearance as those developed under the action of mercurial vapour. This direct and immediate effect of light is certainly remarkable; but the daguerreotype process is not founded on that principle, on account of the slowness of its action; and it is fortunate that, long before light can produce the white precipitate I have alluded to, it operates another

* Communicated by the author, having been read before the British Association at Birmingham, Sept. 14, 1849.

effect, which is the wonderful property of attracting the vapour of mercury. This vapour is condensed in the form of a white powder, having also, when examined by the microscope, the appearance of reflecting crystals. The daguerreotype image is due to this property, which is the most beautiful feature of Daguerre's discovery.

M. Moser has given an ingenious theory of the action of mercury. Knowing that the yellow ray had the property of continuing the effect commenced by light on the iodide of silver, he has supposed that mercury, when in a state of vapour, evolves a latent yellow light, and to the action of that yellow light of mercurial vapour he ascribes the continuation of the decomposition of the iodide of silver. But, as the analysis of the surface discloses the presence of mercury, that metal must have been amalgamated with the silver set free after the action of light. We must, therefore, look for another explanation of the phenomenon.

It is more probable that light exercises a two-fold action on the iodide of silver, whether it is combined or not with chlorine or bromine. By one the iodide is decomposed, and the silver set free is precipitated on the surface in the form of a white powder or small crystals; by the other, which begins long before the former, the parts affected by light have been endowed with an affinity for mercurial vapour.

By means of my photographometer, to the principle of which I shall presently refer, I have been able to ascertain that the pure light of the sun performs in about two or three seconds the decomposition of the bromo-iodide of silver, which is manifested by the white precipitate; while the same intensity of light determines the affinity for mercurial vapour in the wonderfully short space of about $\frac{1}{1000}$dth part of a second. So that the affinity for mercury is imparted by an intensity of light 3,000 times less than that which produces the decomposition manifested by the white precipitate.

For this reason it is difficult to suppose that the two actions are the same. We must admit that they are different. Long before it can effect the decomposition of the surface, light imparts to the sensitive coating the affinity for mercurial vapour; and this appears to be the principle of the formation of the image in the daguerreotype process.

In a paper I communicated to the Royal Society on the 17th of June, 1847 (see "Transactions"), and an abstract of which I read before the association at Oxford, I stated that the red, orange, and yellow rays were destroying the action of white light, and that the surface was recovering its former sensitiveness or unaffected state after having been submitted to the action of these rays. I inferred from that curious fact that light could not have decomposed the surface; for if it had it would be difficult to understand how the red, orange, or yellow rays could combine again, one with another, elements so volatile as bromine and iodine, after they had been once separated from the silver.

But I had not yet been able to ascertain that, when light has decomposed the bromo-iodide of silver, the red, orange, or yellow rays cannot restore the surface to its former state. The action of light, which can be destroyed by the red, orange, or yellow rays, does not determine the decomposition, which would require an intensity 3,000 times greater. It is the kind of action produced by an intensity 3,000 times less, giving the affinity for mercury, which is completely destroyed by the red, orange, or yellow rays. It seems, therefore, that I was right in saying that there was no decomposition of the compound during the short action which is sufficient to give the affinity for mercury, and in ascribing the formation of the image only to that affinity. White light, or the chemical rays which accompany it, communicate to the surface the affinity for mercury, and the red, orange, or yellow rays withdraw it. I must notice here a singular anomaly; viz., that, when the sensitive surface is prepared only with iodine without bromine, the red, orange, or yellow rays, instead of destroying the action of white light, continue the effect of decomposition as well as that of affinity for mercury. Still there is a double compound of iodine which is far more sensitive than the simple compound, and on which the red, orange, or yellow rays exercise their destructive action as in the case of the bromo-iodide.

The phenomenon of the continuing action of the red, orange, or yellow rays, on the simple compound of iodide of silver, was discovered by M. Ed. Becquerel; and soon after M. Gaudin found that not only those rays continue the action by which mercury is deposited, but that they develop without mercury an image having the same appearance as that produced by mercurial vapour.

M. Gaudin, not having observed the fact of the white precipitate, which is the result of the decomposition by the action of light, could not explain the cause of the image brought out under the influence of the yellow ray.

I have observed that the iodide of silver without bromine is about 100 times more sensitive than the bromo iodide to the action of light, which produces the decomposition of the compound forming the white precipitate of silver, while it is 100 times less sensitive for the effect which gives the affinity for mercury. This seems another reason for supposing that the two actions are different. It may be that, in the case of the iodide of silver alone, the decomposition being more rapid, and the affinity for mercury slower than when bromine is added to the compound, the red, orange, and yellow rays, having to act upon an incipient decomposition, have the power, by their own photogenic influence, of continuing the decomposition when it has begun. This may explain the development of the image under red, orange, or yellow glasses, according to M. Gaudin's discovery. But, in the case of the bromo-iodide of silver, the red, orange, or yellow rays have to exert their action on the affinity for mercury, begun a long time before the decomposition of the compound; and they have the property of destroying that affinity.

So that it would appear that all the rays of light have the property of decomposing the iodide of silver in a longer or shorter time, as they have that of producing the affinity for mercury on the bromo-iodide of silver; with the difference that on the former compound the separate actions of the several rays continue each other, and that on the second compound these separate actions destroy each other. We can understand that in the first case all the rays are capable of operating the same decomposition; and that in the second the affinity for mercury when imparted by one ray is destroyed by another. This would explain the various phenomena of the formation of the two different deposits I have described, and also explain the anomaly of the continuation of the action of light by the red, orange, or yellow rays, according to M. Ed. Becquerel's discoveries on the iodide of silver; and of the destruction of that action by the same rays, according to my own observations on the bromo-iodide of silver.

The red, orange, and yellow rays, when acting on an unaffected surface, are considerably less capable than the most refrangible rays of imparting the affinity for mercurial vapour on both the iodide and bromo-iodide of silver; and they destroy that affinity when it has been produced on the bromo-iodide of silver by the photogenic rays. It follows from this fact that, when the red, orange, or yellow rays are more abundant in the light than the most refrangible rays, the photogenic effect is retarded in proportion to the excess of these antagonistic rays. This happens when there exists in the atmosphere some vapours which absorb the most refrangible rays. In these circumstances the light appears rather yellow; but it is very difficult to judge by the eye of the exact colour of the light, and of the proportion of photogenic rays existing in the atmosphere at any given moment.

The vapours of the atmosphere, which render the light yellow, act as any other medium intercepting the blue rays, and those which have the same degree of refrangibility. I prove, by a very simple experiment, the comparative photogenic action of rays which have passed through such media, and of those which have met with no similar obstacle; also that media which intercept the photogenic rays can let pass freely the illuminating rays.

If I cover an engraving one half with light yellow glass, and place it before my camera obscura in order to represent the whole on a daguerreotype plate, I find that, during the time which has been necessary to obtain the image of the half not covered, not the slightest effect has been produced on the half covered with the yellow glass.

Now, if I cover one half with deep blue glass, and the other with the same light yellow glass, the engraving will be seen very distinctly through the yellow glass, and not at all through the blue. In representing the whole, as before, on the daguerreotype plate, the half which was clearly seen by the eye has produced no effect; and the other, which could not be seen, is as fully represented, and in nearly as short a time, as when no blue glass had been interposed.

Thus we might construct a room lighted only through an inclosure of light yellow glass, in which light would be very dazzling to the eye, and in this room no photographic operation could be performed; or a room enclosed by deep blue glass, which would appear very dark, and in which the photographic operation would be nearly as rapid as it would be in open air.

Thus we may conceive certain states of the atmosphere under which there will be an abundance of illuminating rays, and very few photogenic rays; and some others under which the reverse will take place.

Considering how difficult it is to judge by the eye alone of the photogenic state of light, we can understand why the photographer is constantly deceived in the effect he tries to produce, having no means to ascertain beforehand, with any degree of certainty, the intensity of light. For these reasons I turned my attention to contrive an apparatus by which I could test at the same time the sensitiveness of the daguerreotype plate and the intensity of light.

I succeeded in constructing an instrument which I have called a photographometer, the description of which appeared in "The Philosophical Magazine" for the month of November, 1848.

As I have since improved it considerably, and made with it a great number of experiments, I shall briefly refer to this instrument, and describe the useful alterations I have made.

In the instrument described in "The Philosophical Magazine" for November, 1848, the light struck the daguerreotype surface during the passage on an inclined plane of a metallic plate having seven apertures in a horizontal line, following the geometrical progression 1, 2, 4, 8, 16, 32, 64; so that, the daguerreotype plate being covered with another metallic plate having four series of seven holes, the effect of light through every one of the seven holes was represented in proportion to the opening of the moveable plate. Every one of the four series of holes indicated the same number of white spots, and the number of spots was the measure of the light at the moment. I had four series of holes in order to try several preparations on the same plate, or to test the light on the same plate at four different times.

The improvement I have made consists in my being able to shut every one of the holes by means of sliding blades, so that I can continue, by repeated falls, the geometrical progression from 1 to 512 on one plate; and, when a second plate is added to the double apparatus, from 1 to 8,192. This enables me to compare and follow the different effects of light in a considerable range of intensities. This is done in the following manner:—

After having given one fall with all the slides open, I shut one and give another fall, then shut

the second slide and give two falls, and so on, always doubling the number of falls for every new slide shut.

It is by this means that I have been able to discover at what degree of intensity of light the effect called solarization is produced—on well-prepared plates of bromo-iodide it does not begin under an intensity 512 times greater than that which determines the first effect of mercury—and also at what degree the decomposition producing the white precipitate without mercury manifests itself, both on iodide and on bromo-iodide of silver. On the first it is 100 times quicker than on the bromo-iodide, and on the last it is produced by an intensity 3,000 times greater than that which develops the first affinity for mercury.

The slides enable me to try the effect of different insulated rays on plates affected by white light. This is done by shutting one half of each hole in pushing the sliding blades just enough for that purpose. In that state I submit the surface acted on by a great number of intensities of light to the subsequent radiation through red, orange, or yellow glasses, or any other coloured transparent media, in order to examine the action of these radiations on one half of the effects produced by each intensity of light. By these means I have found that, before light has decomposed the surface and produced the white precipitate, the red, orange, and yellow rays destroy the affinity for mercury, and continue it when the decomposition has begun.

In the course of my experiments I noticed a curious fact, which proved very puzzling to me, until I succeeded in assigning a cause to it. I shall mention it here, because it may lead to some further discoveries. I observed that sometimes the spaces under the round holes, which had not been affected by light during the operation of the photographometer in a sufficient degree to determine the deposit of mercury, were, as was to be expected, quite black; while the spaces surrounding them were in an unaccountable manner slightly affected by mercury. At first I could not explain the phenomenon, except by supposing that the whole plate had been previously by accident slightly affected by light, and that the exposure through the holes to another sort of light had destroyed the former effect. I was naturally led to that explanation, having before observed that one kind of light destroys the effect of another; as, for example, that the effect of the light from the north is destroyed by the light from the south when certain vapours existing in the latter portion of the atmosphere impart a yellow tint to the light of the sun. But after repeated experiments, taking great care to protect the plate from the least exposure to light, and recollecting some experiments of M. Moser, I found that the affinity for mercury had been imparted to the surface of the daguerreotype plate by the contact of the metallic plate having the round holes, while the space under the hole had received no similar action. But it must be observed that this phenomenon does not take place every time; some days it is frequent, and in some others it does not manifest itself at all. Considering that the plate furnished with round holes is of copper, and that the daguerreotype plate is of silver plated on copper, it is probable that the deposit of mercury is due to an electric or galvanic action determined by the contact of the two metals; and, perhaps, the circumstance that the action does not take place every time will lead to the supposition that it is developed by some peculiar electric state of the ambient atmosphere, and by a degree of dampness in the air, which would increase the electric current. May we not hope that the conditions being known in which the action is produced, and by availing ourselves of that property, it will be possible to increase on the daguerreotype plate the action of light? For it is not improbable that the affinity for mercury imparted to the plate is also due to some electrical influence of light. How could we otherwise explain that affinity for mercury given by some rays and withdrawn by some others, long before light has acted as a chemical agent?

Photography is certainly one of the most important discoveries of our age. In relation to physics and chemistry, it has already been the means of elucidating many points which had not been investigated, or which were imperfectly known before. We may certainly expect that its study will prove of considerable use to the progress of these sciences. But it is in reference to optics that it opens a large field for research and discovery. Had Newton been acquainted with the properties with which light is endowed in the phenomena of photography, there is no doubt he would have left a more complete theory of light, and of the various rays which compose it.

Since the discovery of photography, opticians have turned their attention to the constructing of new combinations of lenses, in order to increase the illuminating power without augmenting the aberration of sphericity. It is due to justice to state here, that the optician who first produced the best lenses for photography is M. Voigtlander, of Vienna, and they still are the most perfect that a photographer can use, particularly for portraits. In this country an optician of great merit, Mr. A. Ross, has constructed lenses on similar principles; and, at all events, has succeeded in producing some which work as quick, and give an image as perfect in every respect. In Paris M. Lerebours is renowned for lenses with larger focus, which are better adapted for taking views than any I have tried.

From the beginning of photography it was well known that the effective rays, being the most refrangible, had a shorter focus than those producing white light; and for this reason Daguerre himself recommended the use of achromatic lenses, in which all the rays were supposed to coincide nearly at the same focus. All cameræ obscuræ were furnished with achromatic lenses, and constructed so that the plate could be placed exactly at the same distance as the ground glass on which the image had appeared the best defined. But with these cameræ obscuræ it was very difficult to obtain a photographic image so perfect as that seen on the ground glass; and it was only now and then, and as if by accident, that good pictures could be produced.

I soon observed that anomaly, and imagined that it was due to some errors in the respective position of the two frames, one holding the ground glass, and the other containing the plate, which, by warping, or some other causes, might have been shifted to different distances from the object-glass.

Not being able to assign another reason for the error, I constructed a camera obscura in which the ground glass and the plate were exactly placed in the same frame. In doing so I hoped to avoid the least error or deviation. But, to my surprise, the more I was correct in my adjustment, the less I could obtain a well-defined daguerreotype picture. This proved to me that I had to seek for another cause of the difficulty; and, before going any further, I decided to try if the usual focus did or did not really coincide with the photogenic focus. For the experiment I placed at a distance from the camera obscura several screens on different planes: these screens being covered with black lines, I could see them very distinctly on the ground glass. I tried the focus on one of the screens. To my surprise and delight, I found that invariably the one which had come out well defined on the ground glass was confused on the daguerreotype plate, and *vice versâ*. This was sufficient to prove to me the cause of the difficulty I had been labouring under, viz., that the visual focus had not coincided with the photogenic focus. But the most surprising feature of that discovery was, that the photogenic focus was longer than the visual focus. On first consideration it should have been shorter, as the rays operating in photography are the most refrangible. Although I could not at first understand the cause of this anomaly, it was sufficient for me to know that, in order to have a well-defined daguerreotype picture, I had only to set the focus on the ground glass for an object nearer the camera at the distance indicated by the experiment with the various screens. Continuing my experiment, I found some lenses in which the photogenic focus was shorter, and some others in which the two coincided.

I communicated a paper on the subject to the Royal Society and to the Académie des Sciences in May, 1844, and from that time photographers have been able to find the true photogenic focus of their camera; and opticians, who at first denied the fact, have at last studied and considered the question, trying to construct lenses in which the two foci should agree.

M. Lerebours, of Paris, was the first who, on my suggestion, examined the subject; and he communicated a paper to the Académie des Sciences, in which he explained the cause of the difference. He stated that, by altering the proportion between the angles inscribed in the curves either of the crown or flint glass, he could render at will the photogenic focus longer or shorter than the visual focus, and by the same means could bring them to the same point. There is no question that M. Lerebours was right as far as the result referred to the chromatic correction; but if, according to the density of the two glasses, certain curvatures are required to correct the spherical aberrations, these curvatures cannot be altered with impunity only for the purpose of changing the directions of the most refrangible rays. For this reason I have always preferred lenses in which the spherical aberration is the most perfectly corrected, without caring whether the photogenic rays coincided or not with the visual rays, having the means of ascertaining how I could obtain on my daguerreotype plate the best-defined image. In fact, from my own observation that the red, orange, and yellow rays are antagonistic to the photogenic rays, and that the last rays have a greater power when the former are proportionately less abundant, I am of opinion that when the photogenic rays are only condensed on the plate, and the others are dispersed on the space more or less distant from the photogenic point, the action is more rapid. Rapidity being the principal object in photography, I prefer lenses in which the two foci are separated, although the operation is a little more difficult, and requires considerable care.

The question of the photogenic focus is involved in another kind of mystery which requires some attention. I have found that with the same lenses there exists a constant variation in the distance between the two foci. They are never in the same relation to each other: they are sometimes more or less separate; in some lights they are very distant, and in some others they are very near, and even coincide. For this reason I constantly try their position before I operate. I have not been able to discover the cause of that singular phenomenon, but I can state positively that it exists. At first I thought that variations in the density of the atmosphere might produce the alteration in the distance between the two foci; or that, when the yellow rays were more or less abundant, the visual rays were refracted on different points on the axis of the foci, according to the mean refrangibility of the rays composing white light at the moment. But a new experiment has proved to me that these could not be the real causes of the variation. I generally employ two object-glasses; one of shorter focus for small pictures, and the other of longer focus for larger images. In both the photogenic focus is longer than the visual focus; but when they are much separated in one they are less so in the other: sometimes when they coincide in one they are very far apart in the other, and sometimes they both coincide. This I have tried every day during the last twelve months, and I have always found the same variations. The density of the atmosphere, or the colour of light, seems to have nothing to do with the pheno-

menon, otherwise the same cause would produce the same effect in both lenses. I must observe that my daily experiments on my two object-glasses are made at the same moment and at the same distance for each, otherwise any alteration in the focal distance would disperse, more or less, the photogenic rays, which is the case, as I have ascertained. The lengthening or shortening the focus, according to the distance of the object to be represented, has for effect to modify the achromatism of the lenses. An optician, according to M. Lerebours's calculation, can at will, in the combination of the two glasses composing an achromatic lens, adapt such curvatures or angles in both that the visual focus shall coincide with the photogenic focus; but he can obtain this result only for one length of focus. The moment the distance is altered the two foci separate, because the visual and photogenic rays must be refracted at different angles in coming out of the lens, in order to meet at the focus given for one distance of the object. If the distance is altered the focus becomes longer or shorter; and, as the angle at which different rays are refracted remains nearly the same, they cannot meet at the new focus, and they form two images. If the visual and photogenic rays were refracted parallel to each other, in coming out of the lens they would always coincide for every focus; but this is not the case.

It seems, therefore, impossible that lenses can be constructed in which the two foci will agree for all the various distances, until we have discovered two kinds of glasses, in which the densities will be in the same ratio as their dispersive power. There is no question so important in photography as that which refers to finding the true photogenic focus of every lens for various distances. I have described the plan I have adopted for that purpose; by means of that very simple instrument, every photographer can always obtain well-defined pictures with any object-glasses. But there is another method of ascertaining the difference between the two foci, which has been lately contrived by Mr. G. Knight, of Foster-lane, London. That gentleman has been kind enough to communicate to me the very ingenious and simple apparatus by which he can at once find the exact difference existing between the visual and photogenic focus, and place the daguerreotype plate at the point where the photogenic focus exists. I am very glad he has entrusted me with the charge of bringing his invention before the British Association. For the scientific investigation of the question Mr. Knight's apparatus will be most valuable to the optician, as it will afford him the means of studying the phenomenon with mathematical accuracy.

Mr. Knight's apparatus consists in a frame having two grooves; one vertical, in which he places the ground glass, and the other forming an angle with the first destined to receive the plate; the planes of the grooves intersect each other in the middle. After having set the focus upon the ground glass, this last is removed, and the plate is placed in the inclined groove. Now, if a newspaper or any large printed sheet is put before the camera, the image will be represented on the inclined plate; and it is obvious in its inclination the various points of the plate will meet a different focus; the centre of the plate will coincide with the visual focus by its inclination. It will in one direction meet the photogenic focus at a point more or less distant from the centre, if the photogenic focus is shorter than the visual focus, and in the other direction if it is longer. The frame is furnished with a scale of division, having the zero in the centre. When the image is represented on the daguerreotype, by applying against it another moveable scale of division similar to the other, the operator can find what is the division above or under zero at which the image seems best defined; and after having removed from the camera the experiment frame, and set the focus as usual on the ground glass, he has only to move the tube of the object-glass by means of the rack and pinion, and to push it in or out, a space corresponding with the division of the scale indicating the deviation of the true photogenic focus; the tube of the object-glass is for that purpose marked with the same scale of division.

In order to enable the members of the association to judge of the merit of Mr. Knight's invention, I have had his apparatus applied to a small camera with which I made my experiment. By exhibiting at the same time Mr. Knight's method and my own, a comparison of the two may be made, and they will be both better understood.

Before concluding I shall call the attention of all persons conversant with optics to the singular fact I have observed respecting the constant variation of the two foci. I have not been able yet to find its cause, and I leave its investigation to more competent persons. I hope at the next meeting of the association we shall know more on the subject.

THE CHEMICAL TIMES.

SATURDAY, NOVEMBER 10, 1849.

THE PIMLICO-SEWER QUESTION.

After the very lucid, temperate, and convincing supplementary report on the Warwick-street sewer question which emanated from the pen of Dr. Lyon Playfair, we had hoped that Dr. Ure would have seen the policy, if not the propriety, of allowing the dispute to rest. Not so, however. With a temerity that is perfectly unintelligible he rushes into print again—with the same intemperance and self-conceit as heretofore, he spurns the solemn asseverations on a chemical issue of not *one*, but a whole list of British chemists respectable and respected—men whose chemical acquirements are as publicly recognised as their private and domestic relations are above reproach—men who honour chemistry as a science should be honoured—men who are above seeking a spurious public reputation, in the unseemly contests of a sewers commission, to the same extent as Dr. Ure seems desirous of rat-like wallowing and revelling in the same polluted source.

There cannot be a more contemptible perversion of chemical science than that of reducing it to a venal system of special pleading, in which the bright effulgence of Nature's truths is purposely shadowed in the clouds of mysticism—in which the pleader's aim is not to set forth science as it is—a pure emanation of the Creator himself—but to veil and mystify, clip, trim, and distort, until science almost bears the aspect of falsehood itself — not to rejoice in making truth manifest to the unthinking, the ignorant, or the obtuse; but to revel in the unenviable ingenuity of leading her so far astray that she unwittingly encroaches upon the dominion of the father of all lies!

To the chemical world who are capable of judging the sewer contention is transparent enough. Dr. Ure has had full opportunity to set himself right with the world; he has said his say, he has written his book; by this he shall be judged.

Dr. Ure blazons forth the fact that *he* can,—although the *pseudo* professors, as he dares to call them, *cannot*,—obtain large quantities of prussic acid from the matter in Warwick-street sewer. To a chemist the duplicity of this statement is obvious. Taking advantage of a prevailing popular ignorance, Dr. Ure unfairly marshals his facts. The question at issue was whether prussic acid vapour did or did not exist in the fatal drain, not whether it could be eliminated from certain matters there found? The *pseudo* chemists, as they are called, addressed themselves to the plain facts, honestly stated—Dr. Ure to the same facts—twisted, distorted, and mystified. Once give the licence that Dr. Ure arrogates to himself and there is an end to chemical truth. Dr. Ure says that out of the materials of the Warwick-street sewer he can get such and such quantities of prussic acid. Why, he could do this from prussian blue, or from prussiate of potash, yet neither of these bodies is a poison, nor could have contaminated the air in the least degree. Nay, it would not be difficult for even a *pseudo chemist* to make prussic acid enough to kill many individuals by operating according to known methods on potash, oil of vitriol, beef-steak, and an iron nail. But, once allow to chemists this licence before a court of justice, there will be an end to all reliance on their statements. All that we now value in the shape of chemical evidence would be lost in a cloudy mysticism, begotten in the most impure recesses of dishonest minds.

Apothecaries'-hall.—The following are the names of gentlemen who passed their examination in the science and practice of medicine, and received certificates to practise, on Thursday, November 1, 1849:—Joseph Hughes Hemming, Kimbolton, Hunts; John Cox Lynch, Norwood; William Ferdinand Wratislaw, Rugby; Thomas Pettit Wright, Chatteris, Cambridgeshire.

Royal College of Surgeons.—The following gentlemen, having undergone the necessary examinations for the diploma, were admitted members of the college at the meeting of the Court of Examiners on the 2d inst.:—Messrs. Robert Hamilton, Ipswich; John Tompson Goodridge, Paington, Devon; Richard Allanson Gaskell, St. Helen's, Lancashire; Charles Anthony Floyer, Floore, Northamptonshire; William Martin Halfield, Chilham, Kent; Henry Taylor, Bury St. Edmund's, Suffolk; John Gilby Townsend Rossiter, Bristol; Thomas Croft, Bracknell, Berkshire; John Lascelles Nowell, Liverpool; Edward M'Kellar, Madeira; Samuel Reynolds, Debach, Suffolk; and Henry Dixon, Stockton-upon-Tees. At the same meeting of the court Mr. William Evans passed his examination for naval surgeon. This gentleman had previously been admitted a member of the college, his diploma bearing date July 3, 1846.

New Wine-press.—A new wine-press, of simple construction, has been invented by M. Kœpplin, secretary to the Agricultural Society of Colmar. It consists of a metallic vessel, the diameter of which is equal to twice its depth, and which is divided in the middle by a moveable diaphragm of an impermeable fabric. The space above the diaphragm is filled with grapes, and then a perforated cover put on, which is made fast to the top of the vessel. Water is next forced in beneath the diaphragm by means of a pump, and by its irresistible pressure expresses the juice, and causes it to flow through the holes in the cover. Numerous experiments have been made with this machine before the congress of vine-growers, the Agricultural Society of the Haut-Rhin, and the Industrial School of Mulhausen. It is said to work with great facility and rapidity, to occupy little space, and to be easily moved about. The same machine may, no doubt, be employed with advantage for the expression of juice from apples, beetroot, olives, &c.

STATEMENT IN CONTINUATION OF THE ONE PUBLISHED IN THE CHEMICAL TIMES OF NOV. 3, 1849, SHOWING THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE AIR FROM OCT. 28 TO NOV. 3 INCLUSIVE, AS INDICATED BY THE EVAPORATION OF WATER FROM TWO COPPER VESSELS OR SCALES, ONE INSULATED AND THE OTHER NOT. ALSO THE READING OF THE BAROMETER, THERMOMETER, DIRECTION OF WIND, AND GENERAL STATE OF THE WEATHER.

Oct. and Nov. 1849.	Barometer.		Therm.		Scales.				Wind.		General state of weather.
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Insulated	Non-Insulated	Morning.	Evening.	
28	30.30	30.55	59	56	..	5 N.	..	5	NW.	NW.	Overcast all day; very fine night.
29	30.65	30.55	54	53	20 N.	10 N.	..	30	SE.	SE.	Fine all day; heavy dew at night.
30	30.33	30.00	49	52	5 N.	10 N.	..	15	NE.	S.	Ditto - - - ditto.
31	29.80	29.50	51	48	..	..	..	..	SW.	SW.	Ditto.
1	29.45	29.60	50	50	10 N.	..	..	10	SE.	SE.	Ditto.
2	29.60	29.60	48	50	10 N.	30 N.	..	40	NE.	SE.	Ditto - very heavy dew at night.
3	29.50	29.37	50	52	5 I.	..	5	..	E.	E.	Fog and mist morning; overcast all day; fog evening.

It will be seen by the register of the barometer that the mercury fell in three days only no less than one one-fifth inch, without any apparent cause in the weather. The scales, however, equally indicated bad weather; but the excess of evaporation from the non-insulated vessel may be accounted for from the prevalence of the easterly winds, and fog of the 3d.

Westminster-road, Nov. 6, 1849.

Franklin Coxworthy, Author of "Electrical Condition," &c.

FRANKLIN COXWORTHY'S DISCOVERIES IN NATURAL PHILOSOPHY.

[*Continued from page* 237.]

We now proceed to apply the illustration given in our last to the old doctrine of the expansion of matter during the absorption of heat, and its contraction while heat is evolved.

On its passage through the ignited fuel the air is decomposed; the oxygen is converted into carbonic acid, and the nitrogen is evolved; the two gases occupying together a considerably greater space than they did before. They have, therefore, become, by expansion, absorbents of heat, and should, consequently, impart cold to the matter by which they are surrounded. But, on applying heat to frozen water, we find that the ice is first dissolved—the water then increases in volume, instead of contracting—and, ultimately, steam is produced with a vast extension of the space occupied.

Here, then, we have evidence diametrically opposed to the existing doctrine of the entity, or individual existence, of heat, or caloric. And the action of fire on solid matter is not less instructive. If a piece of metal be held in a flame, it becomes first warm, then "red hot," and at length is raised to a white heat; the amount of expansion corresponding with the increment of heat yielded by the flame, itself an expanding body. If, however, we regard the flame as matter in a highly negative state, and hence abstracting from the metal the electricity which holds its particles together, the conclusion is inevitable that the metal must expand in proportion to the quantity of electricity withdrawn from it. And, if the negative state of the flame be rendered sufficiently intense entirely to overcome the electrical affinity, or bond in matter, between the particles of which the mass is composed, to disintegrate, to decrystallize the metal, like ice, it will first pass into a fluid state, and ultimately assume the gaseous form!

Inductive reasoning, infinitely more simple than that which has hitherto fallaciously sustained the old doctrine, is thus, in all honesty, applied to its subversion. That doctrine had, as we have previously remarked, nothing to support it but those hasty assumptions which were mistaken for reasons. Nothing in the way of practical experiment could possibly demonstrate it. It was too illusive to be illustrated. Indeed, any attempt at scientific elucidation could only terminate in the dissipation of what it would be intended to establish. On the other hand, the proposition logically submitted by Franklin Coxworthy is chemically proved by reference to the most familiar facts.

What, then, is the duty of those to whom the public look for instructive conclusions from data thus freely afforded? We essay to perform our portion of it. We make the denial of what has been deemed to be established on a truthful basis, patent to our readers; to that denial we add appreciable argument; and that argument we prove to be correct by the undeniable process of nature herself. Let those who assume the designation or permit themselves to be called philosophers, or men of science, fulfil their functions. Have they the truth on their side? where are the proofs? Is it on ours? Who is he, who are they, to whom truth should be the prevailing aim, the only useful attainment of investigation, and yet will not surrender their prejudices or misconceptions to her sacred summons? If they are right they owe it to society to put down Franklin Coxworthy, as a vain pretender, not by sneers, nor generalities, nor assumptions, nor assertions; but by patient examination, minute development, reasoning upon proved premises, and demonstrating by unmistakeable results. And if they are wrong we thrust aside from before them the flimsy veil, on which is inscribed "Where ignorance is bliss 'tis folly to be wise;" and, bringing them thus face to face with their single opponent and his array of facts, cite them to controversy or confession, by reminding them that they can no longer remain in the beatitude of ignorance, nor longer be allowed to commit a wrong upon the present generation in the semblance of satisfied wisdom.

We hope in our next to pluck another flower from the coronal of their folly. S.

THE PIMLICO SEWER.

The following supplementary report on the cause of this accident has been presented by Dr. Lyon Playfair to the commissioner of sewers:—

"Museum of Practical Geology,
November 1, 1849.

"My Lord and Gentlemen,—A report addressed to you by Dr. Ure has been published in the daily papers. This document contains some substantive experiments and conclusions drawn from them which induce me to lay before you this supplementary report. Do not think that in doing so I will use the personalities or the controversial style which that chemist has thought proper to employ. I shall confine myself, therefore, solely to the subject matter as a means of enabling you to judge between the opinions entertained by that chemist and by myself. Dr. Ure differs from me in two essential points—firstly, in 'averring solemnly that the sewage stuff contains two ounces (*sic* in original) per gallon of pure prussic acid, of pharmacopœia strength;' and, secondly, in thinking that the sewer water derived its sulphuretted hydrogen 'from surface water, impregnated with carbonic acid, which, separating sulphuretted hydrogen, dissolves and carries it down into the sewer, in a loosely-combined state, ready to impregnate the air by the well-known principle of diffusion.'

"On the first point of difference I perfectly agree with Dr. Ure, that any tyro in chemistry can detect the presence of prussic acid in water. I, therefore, do not doubt that Dr. Ure did obtain indications of its presence in the water furnished to him. But I do declare with the same solemnity as if I were still on oath before the coroner's jury, that there was not one eight millionth part of any compound of prussic acid in three specimens of water examined by myself. One of the specimens was taken in my presence, not from the open trench where plenty of gas lime had fallen in, but thirty feet from the opening of the sewer; another was sent to me by the officers of your board, the third was that furnished to Mr. R. Phillips. I have said that not one eight millionth part of prussic acid or its compounds was present, and I derive this small number from the following experiment:—I took one pint of sewer water, and tested it for prussic acid in the way described by Dr. Ure and practised by all chemists. I was unable to detect a trace. I then added to this same pint the proportion of one thousandth part of a grain of cyanide of ammonium, and I found no difficulty in detecting the quantity. Therefore, if the eight million seven hundred and fifty thousandth part of a cyanide had been present it must have been detected. Surely this denoted sufficient delicacy in the test employed. This experiment was performed in the presence of Mr. R. Phillips and others, and convincingly proved that our test would indicate at least one eight millionth part of prussic acid in the sewer water, and yet we found it not. So convinced am I that there was no prussic acid in the sewer water furnished to me on these three different occasions that I would willingly undertake to drink the whole of the product of that acid which Dr. Ure could obtain from the distillation of 10,000 gallons of a similar specimen. I may further state that I have requested Dr. Hofmann, of the Royal College of Chemistry, to examine the sewer water collected by myself, and he has been unable to detect the most minute trace of prussic acid or any of its salts. That there are now indications of cyanides in the sewer water taken from the open trench I do not doubt. I myself, in selecting specimens for experiment, have thrown at least 20 lb. or 30 lb. of the gas lime into the sewer water. I have seen very much more than

this fall in and pollute the already fetid water. But I further declare that at the present time, except in the immediate vicinity of the trench, where this gas lime has fallen in, there is not the least indication of prussic acid. To-day I sent a man twenty-five yards into the sewer in the direction of Warwick-street, and twelve yards in the direction of the butt-end of the sewer, and procured specimens of sewage water from both these parts. In neither of them was there the smallest trace of prussic acid or any of its salts. These experiments were repeated in the presence of several of the most eminent chemists in London, among whom I may mention Professors Graham and Williamson.

"In my first report to you I mentioned that a red colour was given to the sewer water on the addition of a persalt of iron. This, which might show the presence of a sulphocyanide, might also only indicate a sulphite, or many other compounds which give a similar colour.

"I, therefore, cautioned you against accepting this as a perfect demonstration; but it matters not whether this caution was well given or not, for, practically, a sulphocyanide would do no evil. That salt is always found in the saliva of man, and is obviously not poisonous. My view of the accident supposed that a percolation of the cyanides might have taken place, and I was, therefore, prepared to find them in the sewer, though I had shown that the sulphuret could not enter. I have carefully repeated my experiments over and over again, and do not retract one opinion given in my evidence.

"I, therefore, conclude this part of my report by solemnly reiterating that there was not a trace of a cyanide in the water sent to me or taken by myself immediately after the accident; and I further declare, with the same truth, that at the present moment there is not a trace of prussic acid or of its salts in any part of the water of the sewer which is not in the immediate vicinity of the open trench where the gas lime has fallen in. I further state, after the most careful experiments made by myself, and verified by others, that even in the water found in the open trench there is not one hundredth part of the prussic acid which Dr. Ure avers that he has found, and gives as representing the composition of the sewage matters generally. I deny also the possibility that such a result could ever have represented the composition of the water in any part of the whole extent of sewers, because the presence of hydrosulphate of ammonia would have converted it quickly into the totally innocuous sulphocyanide before any such enormous accumulation could have taken place. This sulphocyanide could not have been converted into prussic acid by the processes described by Dr. Ure, as having furnished his product. And, therefore, I can only express my unmitigated astonishment at the marvellous results obtained by this chemist without attempting their explanation.

"I also declare that true specimens of the sewer matter, even when taken from the open trench, do not, at the present moment, give the slightest indication of containing prussic acid or its compounds, when treated by the process described by Dr. Ure. The only form in which they exist in the sewer is in the state of insoluble and inert prussian blue, and can only be obtained from the mud by treatment with an alkali. If, therefore, Dr. Ure has included this insoluble and totally innocuous prussian blue of the mud in the prussic acid which he obtained from the 'fluid' matter, I accuse him of disingenuously stating his results; because, as a chemist, he is well aware that this could not in any way have aided in vitiating the atmosphere.

"I now proceed to examine the second ground of difference as to the cause of the accident. By all it is admitted to have been mainly due to sulphuretted hydrogen, either combined or free. Dr. Ure derives it from the gas lime. I refuse this explanation on the following grounds, laid down in my first report:—

"'1. That direct experiment proves that the iron in the clay underneath the gas lime arrested the sulphuret, and refused it a passage to the sewer.

"'2. That the bricks and mortar were not stained the colour they would have been had the sulphuret from the gas lime passed through.'

"Since I gave my evidence more of the ground above the sewer has been opened, and one place has been discovered where gas lime of considerable thickness rests on the crown of the sewer, to the length of fifteen feet. Did the soluble sulphuret in the sewer come from this? I have carefully taken the worst portions of this bed, and I find that it does not contain a trace of any soluble sulphuret. This, therefore, could not have been the cause. An upper bed was, as I mentioned in my evidence, found to contain a small quantity of a sulphuret; but I proved by experiment that it could not have filtered the underlying clay without being arrested.

"To my direct experiment Dr. Ure gives only a general negative, which, in an experimental science, is no argument.

"The second point he treats equally summarily, stating that 'when gas lime is mixed with water and filtered it affords a nearly colourless liquid, incapable of staining bricks or mortar, or leaving any coloured traces of its infiltration.' To this negation I give a direct contradiction, which chemists may at once determine by experiment. Gas lime liquor, if of sufficient strength, does colour mortar green, and bricks black—the latter only by continued action. I cite further the experience of gas-manufacturers, who find this discoloration in the walls of the vats containing 'blue billy,' the solution having filtered through. Further, I showed to the coroner and jury water from the sewer which acquired this green colour by ten minutes' immersion in the sewer water, which, therefore, ought to have coloured the mortar if its origin had been from the gas lime alone.

"I now beg you to consider Dr. Ure's own hypothesis of the cause of the accident, and, in doing so, I am compelled to expose some strong chemical inconsistencies in his report. I have already quoted his own words, in which he argues that the carbonic acid in rain water percolating through the gas lime decomposes the sulphuret with the production of sulphuretted hydrogen, which finds its way by its diffusion into the sewer. This explanation is absolutely impossible, for the following reason:—The gas lime is the supposed cause of mischief—is not what is technically called blue billy, a kind applied to gas with milk of lime, but is dried gas lime, and still contains a large quantity of hydrate of lime in excess. Now, every chemist knows that the carbonic acid of the rain water in filtering through a bed of considerable thickness would, in the first place, combine with this excess of lime, and be unable to act upon the sulphuret. Dr. Ure himself is involved in this difficulty—that in the very preceding paragraph of his report he acknowledges that the sulphuretted hydrogen in the sewer is not free but combined, for it required the transmission of carbonic acid through the sewer water, 'when nearly scentless,' to evolve the sulphuretted hydrogen. The use of this acid showed that the latter gas was in a state of combination. When, then, did it obtain its base for combination? Not from the lime, for Dr. Ure repudiates this idea, believing that the gas entered the sewer in an uncombined state. It can only, then, come from the ammonia, and, if it come from the ammonia, the latter can only be derived from animal excrements, and in its derivation must have produced an equivalent quantity of sulphuretted hydrogen to combine with it. But I state now, as I have done before, that the sewer water contained an excess of ammonia, and that neither prussic acid nor sulphuretted hydrogen could have been present in an uncombined state. This excess of ammonia could only have been derived from animal or vegetable matter, and would have been accompanied in its formation with far more sulphuret than would be necessary to account for the fatal accident.

"To sum up this argument, Dr. Ure believes the fatal gas to have entered the sewer in a free state, yet his own experiment shows that it was present in the sewer in a state of combination. My conclusion from the experiment is that the combined sulphuret arose from the decomposition of putrid matter, and not from infiltration.

"In concluding the supplementary report I would earnestly call your attention to the following new circumstances before you decide on the cause of the fatal accident:—

"I find that the sewer water at present contains 136 grains of a soluble sulphuret (hydrosulphate of ammonia) to the gallon. I also find by careful experiment that a gallon of a saturated solution of the very worst gas lime above the sewer certainly does not contain twenty grains of any soluble sulphuret. Hence, if the old sewer were filled with a saturated solution of the gas lime, and if it were never diluted by house or surface drainage, there would still be above 100 grains per gallon in excess, so that the solution would only account for a very trifling part of the fatal impurities now in the sewer. This of itself is a perfect demonstration that the gas lime was not the cause of the putrid accumulation, which, therefore, must have arisen as in a common cesspool.

"2. That, supposing the prussic acid compounds did filter into the sewer, they would be quickly rendered innocuous by the soluble sulphuret, which, exposed to air, would form sulphocyanide, a constituent of the saliva of man and all animals.

"3. That, in contradiction to the unconfirmed statements of one chemist, you have the solemn assurance of the following high authorities:—Graham, Hofmann, Millar, Phillips, Warrington, and Williamson; to which I add my more humble, but equally truthful, testimony that, when care is taken to select true specimens, there was not at the time of the accident, nor is there now, any compound of prussic acid in the sewer water.

"Having laid these, my experiments and conclusions, before you, I am fully confident that you will give them full and impartial consideration.

"I have the honour to be,
"My lord and gentlemen,
"Your obedient and faithful servant,
"LYON PLAYFAIR.

"To the Metropolitan Commission
of Sewers."

HEALTH OF LONDON DURING THE WEEK.

[From the Registrar-General's Return.]

The mortality of London, which fell below the weekly average of five autumns in the second week of October, has steadily continued to decline during the three subsequent weeks. The present return shows that only 837 deaths were registered in the week ending last Saturday, while the average is 1,162 (allowance being made for increase of population on previous years); the decrease is therefore 325. A comparison of returns made for the same week in the last ten years shows that in any of the nine weeks the mortality has not been so low as at the present time; in the corresponding week of 1841 the deaths were 840; in that of 1848 they were 1,115, after cholera had given warning of its presence. Only 11 deaths from cholera were registered in last week; in the three preceding weeks they were successively 110, 41, and 25, declining by nearly a geometrical progession. Of the 11, one occurred in Lower North-street, Chelsea; two in the workhouse of St. Martin-in-the-Fields (one having been that of a girl brought from a house in Bedfordbury, the condition of which is minutely described by the registrar); one in Claremont place, Gray's-inn-lane; one in George-yard, Saffron-hill; two at No. 12, Sevenstep-alley, Gravel-lane; one in the Lunatic Asylum, Hoxton-house; one in Maidstone-place, "a very low and ill-drained spot" in Haggerstone (East); one at 4, Paternoster-row, Spitalfields, where the

mother of the deceased died five days afterwards of "diarrhœa;" and one in Wycombe-place, Kent-road. In the last week 40 deaths were registered from diarrhœa and dysentery (the average is 27); in the three previous weeks they were 105, 63, and 51. Two of these in the present return occurred at Jenning's-buildings, Kensington, a locality which has frequently obtained unfavourable notice in the records of the late epidemic. Typhus was fatal to 37 persons; the average is 56. Other epidemics are still under the average. The mortality from smallpox and measles continues unusually low. A woman of 57 years died of "inflammation from a plum-stone lodging, 33 days before death, in the colon, and producing thickening and complete obstruction."—Post mortem. In two cases intemperance is stated to have been the cause of death.

The mean reading of the barometer at Greenwich was upwards of 30 inches on the first three days of the week. The mean of the week was 29.807. The mean temperature of the week was 50.3°, which is 4° above the average of the same week in seven years.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Bartholomew Beniowski, Bow-street, Covent-garden, major in the late Polish army, for improvements in the apparatus for and process of printing. Patent dated April 26th, 1849. Enrolled October 26th, 1849.

These improvements refer to a system of printing from types arranged on the inside circumference of a cylinder, which was the subject of a patent granted to the same gentleman in 1847.

1. He now proposes to coat the nick and back surfaces of the types, for about one half their length from the foot, with two or more layers of any suitable varnish, and subsequently to dress them, in order to give them a tapering form, and thereby obtain a cylindrical printing surface. When the types are employed to print from the outside periphery of a cylinder, they are, of course, coated from the top downwards. They are cleansed by passing a few blank sheets of paper through the machine, then sponging them with water to prevent the turpentine, with which they are afterwards to be brushed over, acting on the varnish. Blank sheets of paper are subsequently passed through, and the types will present as clean a face as when cast.

2. He further dispenses with the use of the monthpiece in type-mould (used in his former machine), and makes the channel through which the metal is pumped in the side of the carriage.

3. He cuts notches in the divisions of the case, to enable the legs of the tweezers employed in composing type, according to the patentee's system, to enter and seize hold of such type as may rest against the partitions.

4. He supports the composing-stick upon one of the faces of an angular piece of wood, which is attached to the top of a revolving vertical rod, supported in a bracket screwed to the front of the table, to prevent the compositor from being obliged to carry the stick full of type, which often produces deformity by causing one shoulder to be higher than the other.

5. He protects the substance of which inking rollers are composed from atmospheric influences and injury in rapid printing, by enclosing them in tubes of vulcanized indiarubber, or other suitable material; and he makes inking rollers of tubes composed of some impermeable material, filled with water, and fitted with stuffing-boxes at both ends, through which the axle is passed.

6. The patentee next describes an improved concave-cylinder printing-machine, which consists of a cylindrical framework, containing the main cylinder, which is driven by a number of anti-friction rollers, arranged around its periphery. The form is fixed on a portion of the inside circumference, and around it are placed the ink supplying and distributing rollers. The printing roller is placed after the last distributing roller, behind which, and within the main cylinder, are placed the delivery and receiving boards. The paper is placed on the delivery board, underneath the paper-supplying roller, supported in a vibratory frame on one end of a lever, which is made to rise from the paper, just before the arrival of the form in front of the printing roller, by the action of a cam on the edge of the main cylinder. An endless band of blanketing, with strips of some sticky substance upon its external face, is passed round the paper-supplying roller, so that at each fall and rise they will lift up a sheet of paper by adhesion. In front of the supply roller, and supported in the vibratory frame, are several wires, the free ends of which take into the spaces between the strips, and throw the paper down, which is still slidden forward until it is laid hold of by a projection in front of the form, and thereby drawn between the printing roller and the type. At each end of the main cylinder is a polished "skating rail," above which revolves an endless band, with "skating pieces" attached thereto, while beneath is the receiving-board. As the printed sheet issues from between the printing roller and the form, it is pressed by the skating pieces upon the skating rails, and thereby pushed up them until the pieces come uppermost, and consequently allow the paper to fall through the rails, on to the receiving-board beneath. Two or more apparatuses may be adapted to the cylinder, so that the same number of impressions may be struck off at each complete revolution; and the vibratory frames may be worked by a boy instead of by cams, on the other edge of the cylinder.

Claims.—1. The mode of manufacturing type for printing from a cylindrical surface by coating a portion of their nick and back surfaces with some suitable varnish.

2. Making moulds for casting types with channels in the side, and dispensing with mouth-pieces.

3. The cutting notches in the partitions of cases.

4. The arrangement of apparatus for supporting the composing-stick.

5. The mode of protecting the substance of which inking rollers are composed from injury, either from atmospheric influence or the centrifugal force developed in rapid printing, by enclosing it in a tube of vulcanized indiarubber, or other suitable material.

6. Manufacturing inking rollers of tubes composed of some impermeable material, and filled with water.

7. The arrangement of apparatus for feeding in the paper.

8. The arrangement of apparatus for delivering the paper.

9. The employment of strips of some sticky substance for lifting the sheets of paper successively.

10. The apparatus for causing the blanketing which carries the strips to fall and rise with sheets successively.

11. The substitution of a sliding motion for a rolling one in printing.

12. The adoption of any of these methods to other printing-machines.

George Simpson, Newington-butts, chemist, and Thomas Foster, Streatham, manufacturer, for improvements in manufacturing or treating solvents of indiarubber and of other gums or substances. Patent dated April 26th, 1849. Enrolled October 26th, 1849.

1. Bisulphuret of carbon is placed in an iron still, the top of which opens into an earthenware vessel containing pentachloride of antimony, and a pipe leads from the top of this vessel to the worm of an earthenware condenser. The still and first vessel are heated by steam-jackets. The resulting product flows from the condenser to a reservoir, after which it is rectified by lime, and is then ready for use as a solvent. Before rectification the indiarubber, gutta percha, or other gum may be immersed in it, or exposed to its fumes, and thereby rendered less liable to injury from the effects of cold or heat.

2. Coal oil is purified and rendered applicable as a solvent of these gums by being subjected to a similar process, chloride of lime in solution being substituted for the pentachloride of antimony.

Claims.—1. The manufacture of chloride and bichloride of carbon, and its application as a solvent of indiarubber, gutta percha, and other gums not soluble in water, and the mode of treating rubber as described.

2. The mode of treating coal oil with chloride of lime, for the purpose of obtaining a better solvent of the before-mentioned gums.

Robert Oxland, Plymouth, chemist, and John Oxland, of the same place, chemist, for improvements in the manufacture of sugar. Patent dated April 26th, 1849. Enrolled October 26th, 1849.

The improvements of the Messrs. Oxland are confined to the defecation and decolorization of sugar, and consist in the employment for the purpose of acetate of alumina. The mode of operation which they prefer is as follows:—The sugar is dissolved in water, and heated to 210° F. by steam flowing through a flat coil of pipes. Carbonate of lime is mixed with this saccharine solution to destroy the acidity; after which it is run through filter-bags into a shallower blow-up pan than was first used, where it is mixed with acetate of alumina, and boiled until nearly the whole of the acid is evolved, which can be ascertained by testing the steam with blue litmus paper. The pan is fitted with an air-tight cover and pipe for conveying the acid fumes to a condenser, whereby they may again be rendered available for the manufacture of acetate of alumina: whatever quantity of acid may remain in the syrup after the evaporating process is neutralized by the admixture of carbonate of lime. Cane and beetroot juice may be defecated by this process, either before or after concentration, and clarified by the employment of albumen, bullock's blood, or other well-known agent in the usual way. The acetate of alumina is prepared by mixing with a solution of sulphate of alumina a solution of soda-ash, so as to produce an alkaline reaction on reddened litmus paper. The mixture is allowed to precipitate, and the clear liquid is decanted off. The precipitate is removed and washed repeatedly with water, until the hydrometer fails to indicate the presence of any soluble matter; the acid is then added in sufficient quantity, but not in excess, to form the acetate of alumina. The solution of tannin is composed of crushed valonia in water. The quantity of acetate which the patentees employ for one ton of average sugar is 4 lbs.

Claim.—The use of acetate of alumina in the defecation of saccharine solutions, and removal of colour during the refining of raw sugar.

Thomas Harcourt Thompson, Blackheath-hill, C.E., for certain improvements in apparatus for preventing the rise of effluvium from drains, sewers, cesspools, and other places, and in apparatus for regulating the level of waters in rivers, reservoirs, and canals. Patent dated April 26th, 1849. Enrolled October 26th, 1849.

1. To "prevent the rise of effluvium," &c., Mr. Thompson uses a trap made of a cylinder with a hanging bottom and a spring catch or click, which falls down suddenly when the refuse has accumulated in the cylinder beyond a certain weight, and allows it to fall through, after which the bottom returns to its first position; and, in order to render the trap more air-tight, a ring of vulcanized indiarubber or gutta percha is interposed between the bottom and the lower edge of the cylinder.

2. A similar apparatus is adapted to the pans of water-closets, and connected with the water-supply pipe, so that the fall of the bottom turns on the water to wash round the pan, and *vice versâ*.

3. To regulate the level of water he employs a

ballcock which consists of two vertical pipes sliding tightly one within the other. The inner pipe is connected to the water main, and contains a cone fixed on the lower part of a rod, which is attached to the top of the inside pipe. A piston, the top surface of which is equal in area to the bottom surface of the cone, is attached to the bottom of the rod, and water caused to flow into this space. By this arrangement the pressure will be balanced, and free passage given to the water to the inner tube, whence it flows out through two prolonged arms to the cistern. The outer tube passes through, and is attached to an air-tight ball, and is provided with two long slots, to allow the projecting arms (which serve to carry the water clear of the ball) to pass through. As the cistern fills the ball will move upwards, carrying with it the outside pipe, and consequently the cone, which will have the effect of cutting off the water.

4. A self-acting apparatus is described for opening sluice-gates, according to the level of the water upon one side; it consists of two cylinders, communicating with the water and fitted with two hollow pistons, which are respectively connected to the two ends of a cross-bar attached, in the centre, to the top of a vertical rod fixed to the sluice-gate.

Claims.—1. The arrangement of apparatus for preventing the rise of effluvium from drains, &c., by means of a hinged bottom acted on by a spring click; and the ring of indiarubber or other suitable material.

2. The constructing of apparatus for trapping water-closet pans, and turning on the water.

3. The construction of apparatus for regulating the level of water in reservoirs by means of two pipes sliding one within the other.

4. The construction of apparatus for regulating the level of water in canals, &c., by means of sluice-gates worked by hollow pistons.

William Henry Burke, Tottenham, manufacturer, for improvements in the manufacture of airproof and waterproof fabrics, and in the preparation of caoutchouc and gutta percha, either alone or in combination with other materials, the same to be applicable to articles of wearing apparel, bands, straps, and other similar useful purposes. Patent dated April 26th, 1849. Enrolled October 26th, 1849.

1. Mr. Burke proposes to employ a compound of antimony instead of sulphur for the purpose of rendering caoutchouc, gutta percha, or their compounds permanently elastic and unaffected by changes of temperature. The compound is prepared by mixing 1 part of crude antimony with 25 parts of crystallized carbonate of soda or 20 parts of carbonate of potass, and 250 or 300 parts of water. The mixture is boiled from half an hour to three quarters, and allowed to precipitate, when the supernatant liquid is run off. The precipitate is then dried and incorporated with the caoutchouc in a masticating-machine, in the proportion of from five to fifteen per cent. When bands or other articles are to be cut from blocks of caoutchouc it is taken, while warm, from the masticating-machine and subjected to pressure for one or two days.

2. It is also proposed to manufacture driving-bands by spreading the material, dissolved in a suitable menstruum, with calender-rollers upon pieces of calico or other fabric powdered with French chalk, to allow of the easy separation of the two; and, to increase the rigidity and durability of gutta percha driving-bands, strips of some fabric are to be affixed to the wearing parts, and both surfaces coated with the antimonized caoutchouc.

3. To remove the shiny appearance of single-texture garments, &c., Mr. Burke coats them with the antimonized caoutchouc, dissolved in some suitable menstruum, and mixed with ground silk or cotton, which is stated to have the effect of giving the article the appearance of cloth.

4. Gutta percha soles and heels are proposed to be defended at the edges, where they are exposed to great wear and tear, with metal tips, shields, and guards.

Claims.—1. The treating caoutchouc, gutta percha, or their compounds with the antimony compound.

2. The mode of manufacturing driving-bands.

3. Coating waterproof articles with antimonized caoutchouc, mixed with ground silk, cotton, or wool.

4. The manufacture of gutta percha soles and heels with metal tips, shields, and guards.

John Horsley, Ryde, Isle of Wight, practical chemist, for certain improvements in preventing incrustation in steam and other boilers; also for purifying, filtering, and otherwise rendering water fit for drinkable purposes. Patent dated April 26th, 1849. Enrolled October 26th, 1849.

The first branch of Mr. Horsley's invention consists in the employment of various well-known chemical agents to precipitate the calcareous and other "adventitious matters" held in suspension in the water. To "purify, filter, and otherwise render water fit for drinkable purposes," he draws off, by a syphon, the supernatant liquid from the precipitates.

Alphonse Garnier, late of Paris, but now of South-street, Finsbury, merchant, for certain improvements in extracting and preparing colouring from orchil. (A communication.) Patent dated April 28th, 1849. Enrolled October 28th, 1849.

M. Garnier remarks, that in extracting the colouring matter from lichens, according to the present mode, the lichens are bruised or crushed, and placed in a trough containing water, along with the alkalis for extracting the colour, where they remain for several months, until they assume the consistency of paste, which contains, besides the tinctorial extract, ligneous particles, resinous and chlorophylous gums, and other unimportant substances. Now, the object of the present invention is to separate the tinctorial from the foreign matter, previously to operating on it with chemical agents, by crushing the dye lichens, and washing, boiling, or distilling them to obtain a decoction, which is to be filtered for the purpose of separating the ligneous particles. Liquid deuto-chloride of tin is then added, and allowed to precipitate, after which the liquid is poured off, and the remaining precipitate is the substance from which the colouring matter is to be extracted by the application of known chemical agents.

Claim.—Operating upon the colouring matter of dye lichens, or orchil, alone with chemical or physical agents, and obtaining it in a purer state.

PATENTS RECENTLY EXPIRED.

S. Colt, London, gentleman, for certain improvements applicable to firearms. Patent dated October 22d, 1835; expired October 22d, 1849.

R. Barber, Leicester, cotton-winder, for an improvement in reels for reeling. Patent dated October 22d, 1835; expired October 22d, 1849.

S. Slocum, London, engineer, for improvements in machinery for making pins. Patent dated October 22d, 1835; expired October 22d, 1849.

J. Dyer, London, merchant, for improvements in the materials for fining and clarifying liquids. Patent dated October 22d, 1835; expired October 22d, 1849.—(Communication.)

W. Patterson, Dublin, gentleman, for an improvement in converting hides and skins into leather, by the application of matter obtained from a material not hitherto used for that purpose. Patent dated October 22d, 1835; expired October 22d, 1849.

J. Baring, London, esquire, for a machine for combing and brushing wool, flax, and other fibrous materials, into teeth set in a cylinder, or otherwise, for the purpose of separating the longer from the shorter fibres. Patent dated October 23d, 1835; expired October 23d, 1849.—(Communication.)

TO CORRESPONDENTS.

"A Watchmaker."—The best oil for diminishing friction in delicate machinery is that which is entirely deprived of every species of acid, and of mucilage, and is capable of enduring intense cold without congealing. The oil, in fact, should be pure elaine, without any trace of stearine. Now, it is not difficult to extract the elaine from all fixed oils, and even those from seeds, by the process of Chevreul, which consists in treating the oil with seven or eight times its weight of alcohol almost boiling hot, decanting the liquid, and exposing it to cold. The stearine will then separate in the form of a crystalline precipitate. The alcoholic solution is then to be evaporated to a fifth of its volume. What is left is the elaine, which ought to be colourless, insipid, almost without smell, without any action on the infusion of turnsole, having the consistence of white olive oil, and with difficulty coagulable. Another method of obtaining elaine, more simple and exact than the former, is that adopted by M. Bracconol, which is to squeeze tallow between the folds of very porous paper, by which the elaine is absorbed, while the stearine remains. The paper, being afterwards soaked in water, and pressed, yields up its oily impregnation. In the "Annales de Chemie," March, 1823, another mode of obtaining elaine is given by M. Peelet, to which a preference over both the former processes is given, on account of the facility with which it may be procured in quantity. It is as follows:—Pour upon oil a concentrated solution of caustic soda; stir the mixture; heat it slightly, to separate the elaine from the soap of the stearine; pour it on a cloth, and then separate by decantation the elaine from the excess of alkaline solution.

"Chemicus."—We have read the letter alluded to by our correspondent. Though we by no means agree with Dr. Brett in his sweeping and most unsubstantiated rejection of Liebig's chemical theory of the action of poisons on the animal economy, yet we cannot help deprecating the harsh and even offensive manner in which "A Friend of Liebig" speaks of Dr. Brett's scientific position and acquirements.

"Mr. E. Hallis, Dudley."—We have used every effort to obtain some more accurate information on the subject of the distillation apparatus described in a former number, but, we regret to add, without success.

"A Laundress."—We strongly recommend our correspondent to try the *Improved Washing Fluid*, prepared and sold by Messrs. Twelvetrees, of Milman-street, Bedford-row, by which a great saving of time and labour may be effected without the slightest injury even to the finest fabric.

"P. R. S."—One part of concentrated acid to four parts of water.

"T. O."—Will our correspondent favour us with his name and address, in confidence?

"C. T."—Precipitate a salt of copper with neutral chromate of potass; or dissolve hydrated peroxide or carbonate of copper in chromic acid. Caustic ammonia dissolves the salt obtained by either of these processes. The solution is of a magnificent dark green colour. On the addition of spirit of wine to the solution, ammonio-chromate of copper, or cupro-chromate of ammonia, subsides in the form of a powder of a splendid, rather dark green appearance. The readiest way of preparing this permanent and beautiful colour is to add solution of chromate of potass to ammoniacal sulphate of copper.

THE CHEMICAL TIMES is the only chemical journal which is devoted to the consideration of the science in all its branches. Gentlemen may procure it by an order on any newsman or bookseller, or it will be sent direct from the office, 320, Strand, to regular subscribers. All literary or scientific communications to be addressed to the Editor, 320, Strand.

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ORIGINAL SERIES.

A COURSE OF PRACTICAL PHARMACY.

By Professor SOUBEIRAN,
Pharmacien en Chef of the Hospitals of Paris, &c.

PART II.

ON MEDICINAL SUBSTANCES SUPPLIED BY VEGETABLE AND ANIMAL MATTERS.

LECTURE LXXXI.

(LECTURE CXIV.)

VEGETO-ALKALIS—(*Continued*).

SOLANIA—ATROPIA—HYOSCYAMIA—DATURIA—(*Continued*).

ATROPIA—(*Continued*).

Atropia possesses in an eminent degree the property of dilating the pupil. It produces, besides, all the medicinal and toxical effects of belladonna.

This alkali is produced best by the following process (Geiger's):—Treat dry (recently gathered) root of belladonna with alcohol of 96 Cent. (40° Cartier) until the whole of the soluble principles are removed. Add to the tincture thus obtained a quantity of slaked lime equal to the one twentieth part of the root (by weight). Let the mixture stand twenty-four hours; filter, acidulate the filtrate very slightly with sulphuric acid, and filter again. Draw off by distillation two thirds of the alcohol used in the process of extraction. Evaporate the remainder rapidly, but at a very gentle heat, until there remains a quantity equal to the one twelfth part of the root (by weight). Add to this residuary fluid solution of carbonate of potass until a greyish-brown precipitate commences to form. Take care not to render the fluid alkaline. Let the mixture stand twenty-four hours; filter, and add to the filtrate carbonate of potass as long as a precipitate continues to form. Let the mixture now stand again twenty-four hours; collect the precipitate on a filter, dry it between folds of blotting-paper, and finally in the stove. Dissolve the dry precipitate in five parts of alcohol of 96 Cent., and add to the alcoholic solution gradually charcoal until the fluid exhibits scarcely a shade of yellow; during the addition of the charcoal the fluid should be frequently stirred. Filter, and evaporate part of the alcohol; or, mix the filtrate with six times its volume of water, and place the mixture in a dark and cool spot, to permit the atropia to crystallize.

HYOSCYAMIA.

Hyoscyamia is found in the leaves and seeds of hyoscyamus. It is extracted with greater facility from the seeds than from the leaves; but it is always more difficult to obtain than atropia, because it is more readily soluble in water than the latter alkali, to which it bears, however, in most other points a very strong resemblance.

Hyoscyamia crystallizes in silky needles; it has an acrid and disagreeable taste. It dilates the pupil very strongly. It volatilizes almost unaltered, yet a little ammonia is invariably evolved in its volatilization; this is the case even when hyoscyamia is treated with water.

Iodine forms a brown precipitate in solutions of hyoscyamia; infusion of gallnuts a white, chloride of gold a yellowish-white, precipitate. Chloride of platinum fails to precipitate hyoscyamia.

Hyoscyamia suffers the same remarkable alteration by protracted contact with water and air as atropia; and, like the latter alkali, it does not lose its poisonous properties by this transformation.

APOTHECARIES'-HALL.—The following are the names of gentlemen who passed their examination in the science and practice of medicine, and received certificates to practise, on Thursday, the 8th of November, 1849:—David Henry Monckton, Brenchley, Kent; Alfred Scotchburn, Driffield, Yorkshire; Thomas Bolland Powell, Knaresborough; Edward Rutley Ray, Millon, near Sittingbourne; Robert Smith, Mamley-cum-Chapel, Lincolnshire; Frederick John Dyer.

ORIGINAL COMMUNICATIONS, TRANSLATIONS, ETC.

GENERAL CONSIDERATIONS ON THE ELECTRO-CHEMICAL THEORY.*

By M. BECQUEREL.

When the principles which serve as the bases of a theory are still matter of controversy, and when new discoveries daily throw light on their nature, it is good philosophy occasionally to submit them to fresh discussion, to ascertain whether they should be maintained or modified; such is the object I have proposed to myself in the memoir which I have now the honour of presenting to the Academy, on the electrical effects produced in chemical actions, and in the contact of bodies in general,—effects which were adduced but a few years back by one of the great scientific lights of Europe, to demonstrate the electrical state of atoms before and after their combination, and, consequently, the identity of affinities with electrical forces. This subject has unceasingly occupied my attention for thirty years, in an experimental point of view, and, consequently, abstracted from every preconceived idea concerning the nature of atoms, the most direct means of arriving at the truth.

I will first recapitulate the electro-chemical theory, as I explained it in 1840 ("Traité Experimental de l'Electricité et du Magnétisme," tome vi., page 333), in order that my replies to the objections made to it may be better followed.

Are the action of heterogeneous particles on each other, in chemical actions, as well as that of similar particles in aggregation, due to electrical forces, or to forces proper to matter, and whose nature is unknown to us? This question has, for more than forty years, been agitated between natural philosophers and chemists,—a question raised by Davy; developed by Berzelius, who made it the basis of his electro-chemical theory; explained by Ampère in another point of view; disputed by several chemists, and reduced to its just estimation by the discussion of facts.

Davy, in the Bakerian lecture of Nov. 10, 1806 ("Philosophical Transactions," 1807), explained his views concerning the relation which he supposed to exist between affinities and electrical forces. Among the substances which combine chemically, all those whose electrical energies are well known manifest, says he, opposite electrical states by their mutual contact, and, supposing a perfect freedom in the motion of their elementary particles, they should attract one another by virtue of their electrical powers. Supposing, therefore, two bodies, whose molecules are in a different electrical state, and that these states are sufficiently exalted to give them an attractive force superior to the power of aggregation, a combination is formed which will be more or less powerful as the energies are more or less perfectly balanced, and the change of properties will correspond proportionally. At the same time there is an immediate recomposition of the two electricities, and a disengagement of heat, which is the result of it.

Berzelius, who admitted this doctrine, regarded electricity as an ethereal fluid, of unknown nature, diffused throughout Nature, penetrating all bodies with the same facility as light passes through glass, and dividing itself, in certain circumstances, into two principles endowed with diametrically opposite properties, and bearing no analogy to matter, of which it is not even a property, in that it is transmissible from one body to another. Entirely acknowledging the mutual independence of electricity and matter, he nevertheless admitted between them an intimate relation. Berzelius afterwards compared atoms to small electric piles analogous to tourmalines, which acquired polarity by heat, supposing, besides, that the two poles had not the same intensity; he thus made the combination of heterogeneous atoms to depend on the attractive action of poles of contrary names, whose electrical state was exalted by heat. I will recur to this polarity.

Ampère supposed that atoms possessed an electricity of their own, of which the species depended on the part which they enacted in combination, and which they could not lose without ceasing to exist; that this electricity was disguised by an atmosphere of contrary electricity, when they made no part of a combination; that hydrogen, the alkalis, and the oxides were electro-positive—oxygen and the acids electro-negative.

Before discussing these systematic views, I will recapitulate the principal facts serving to establish a dependence between affinities, the force of aggregation, and electrical forces. When we cleave, with suitable precautions, a crystal of a substance which is a bad conductor of electricity, each part separated carries with it an excess of contrary electricity, arising from the destruction of the aggregation. In operating in the dark, especially with plates of mica, a feeble light, due to the recomposition of the greater part of the electricities disengaged, is perceived.

In the same circumstances, crystallized conductors give no electricity, because those which are disengaged recombine immediately, before having acquired sufficient tension for producing light.

In friction the disengagement of electrity arises from a derangement in the equilibrial position of the molecules; surfaces whose particles have most flexibility have a tendency to acquire negative electricity, whilst those whose particles are less easily displaced ordinarily take positive electricity. I say ordinarily, because we cannot erect into a general law those results which sometimes depend on causes which elude all investigation. Pressure produces analogous effects, which are so much the more marked, as the surfaces have adhered more to each other; and, when they are separated, a kind of cleavage is produced, and, consequently, electrical effects analogous to those produced in cleavage. It is evident, then, that by destroying molecular attraction there is a disengagement of electricity; and, on the other hand, when an isolated conducting body is submitted to the action by influence of an electrized body, an excessively small portion of its natural electricity is decomposed: the two electricities which proceed from it recombine as soon as the electrized body is removed. This action is so much the more energetic, as the first is a better conductor, as the latter has a more powerful tension, and as the bodies approximate more, whilst the electrical attractions and repulsions are exerted in the direct ratio of the quantities of electricity, and in the inverse ratio of the square of the distance. At the same time the forces which unite the molecules are weakened, and so much the more as the action is greater; cases occur in which it has even power to separate them. The decomposing action of the pile is an example of it, and lightning, when it strikes these objects, furnishes many instances. The general facts which I have just related indicate relations between chemical forces and electrical forces, which relations will immediately become more extended, but which already show the existence of two electricities in the molecular interstices of bodies, as well as their expansion when the natural equilibrium of the molecules is disturbed by mechanical actions, or actions by influence.

This quantity of electricity, which resides in the interstitial spaces, and which is indispensable to the constitution of bodies, is capable of alarming the imagination, as I will presently show; it may serve to reveal to us the degree of force by virtue of which affinities retain in contact heterogeneous atoms. I pass to the relations observed between electricity and heat. Every time that heat is propagated in a closed metallic circuit, and that it meets with an obstacle to its free propagation, a disengagement of electricity results, which is rendered sensible by the pro-

* "Annales de Chimie et de Physique," Sept., 1849.

duction of an electric current, whose direction indicates that positive electricity ordinarily overcomes the obstacle. It would seem, then, that heat, when it is not freely propagated in a body, is decomposed into two elements, positive electricity and negative electricity; at least, if it is not so, it appears so.

Reciprocally, when the electric fluid circulates in a body, if it meets with an obstacle to its passage, heat is immediately produced on it at the precise spot where the resistance exists. This reciprocity of electrical and calorific effects during the motion of heat and electricity in bodies establishes a mutual dependence between these two agents.

But as heat, in dilating bodies, produces a commencement of cleavage, and, consequently, a disengagement of electricity, the two electricities, having become free, in recombining, if the bodies are bad conductors, give rise to luminous effects analogous to the phosphorescence produced in the same circumstances; or else, if they are conductors, to electric currents, as, for example, bismuth, antimony, iron, &c.

This more or less immediate recomposition of the two electricities likewise occurs when crystalline bodies which are bad conductors are bruised in an agate mortar, because lamellæ, possessing some positive and some negative electricity, are always in contact.

In some regularly-crystallized substances, such as tourmaline, topaz, &c., heat determines a distribution of electricity, as in electrical piles; these crystals are then endowed with polarity, which exists, however, only in proportion as the temperature is raised or lowered, for it disappears when it is stationary. In this case the electrical effect is the result of the dilatation or contraction of the molecules.

We cannot, therefore, compare the electrical properties of atoms with those of a tourmaline, since in the latter these properties are only transient; whilst, according to the ideas of Berzelius, they would be always augmented by heat in the atoms, whether the temperature were stationary or not.

Experience teaches us also that heat seems to be propagated in bodies by a series of decompositions and recompositions of natural fluid, which are operated in such a manner that the particle which is first heated takes from the source of heat positive electricity, and transmits to it negative electricity: this particle behaves, with regard to that which follows it, as the source of heat did to it; and so on until the temperature has become the same throughout all parts of the body.

Now, as heat is propagated in bodies by radiation from molecule to molecule, we are induced to believe that this radiation is operated likewise by a series of decompositions and recompositions of natural fluid.

Finally, the thermo-electrical phenomena produced in closed metallic circuits show us likewise intimate relations between heat and electricity, in which the conducting power and specific heat concur.

Davy is the first, as I have already stated, who expressed the opinion that heat was formed by the union of the two electricities. He endeavoured to demonstrate it by means of his remarkable experiments on heat and light produced in vacuo by the discharge of a very powerful pile between two charcoal points; but as, in this experiment, the two electricities carry with them material particles, it is not known to what point these latter intervene in the production of calorific and luminous effects. It might, indeed, be that the electricity impresses, by means of its excessive velocity, such a vibratory motion on these particles that they become apt to emit an enormous quantity of heat and light. At any rate, it must always be borne in mind that electricity, when it passes from one body into another, always carries with it matter; and that when the secondary medium, or the conductors, cannot furnish it to it, the calorific and luminous effects cease to be manifested, and the electricity escapes in the state of diffusion, which happens in vacuo over mercury or other liquids which are not sensibly vaporizable.

In order to estimate precisely the relations existing between heat and electricity, I will detail the two laws which govern the disengagement of heat produced by the passage of electricity into the metal wires.

First Law.—Whatever may be the length of a metallic wire, if its diameter is uniform, and the quantity of electricity invariable, the elevation of temperature is the same at any point whatever.

Second Law.—The quantity of heat produced is in the direct ratio of the resistance to conductibility, and proportional to the square of the quantity of electricity which passes.

These two laws establish well the relations which connect together electricity, heat, and matter. I pass to the relations which exist between affinities and electrical forces, which relations will complete all the data on which we should rely for establishing an electro-chemical theory.

When an acid is combined with an alkali, the former liberates positive electricity, and the latter negative electricity. These two electricities, with the exception of the very small quantity which the apparatus removes, immediately recombine in the liquor to form again neutral fluid. Now, as in the same circumstances there is a production of heat, it has been thought that the heat must be caused by this recomposition, which, being effected by the medium of material particles which occur in the passage of the two electricities, gives rise to an affinity of partial currents, which disengaged so much the more heat as the chemical action was more vivid, and the material particles conducted less electricity. This is only an hypothesis, it must be admitted, but it is an hypothesis to which M. Joule has endeavoured to give some confirmation by maintaining, by aid of some experiments, that the heat disengaged in combustion is produced by the resistance which electricity experiences in passing from oxygen into the combustible body at the moment of combination.

If the law advanced by Joule was verified in all chemical actions, it would be proved that the heat disengaged in the reaction of two bodies on one another is due to the resistance which the two electricities experience when set free, in recombining by running through the material particles which are found in their passage.

In the oxidation of a metal, or of another body, oxygen acts like an acid, the metal or other body like an alkali.

In general, when two bodies react on each other, that which acts the part of acid disengages positive electricity, and that which acts as an alkali, negative electricity.

In decomposition the chemical effects are inverted; that is to say, the acid disengages negative, and the base positive, electricity. It is evident, then, that affinities and electrical forces are always concomitant and in mutual dependence. In double decompositions there is no disturbance of the equilibrium of the electrical forces, since it is impossible to collect the slightest traces of electricity with the most delicate apparatus.

An acid solution, with respect to water, behaves like an acid in combining with an alkali or an oxide, and the latter like an alkali. An alkaline solution acts towards water as an alkali towards an acid; thus, in one case, water behaves like an alkali, and in the second like an acid.

A saturated neutral solution acts like an acid with regard to the same solution diluted. Now, as there is no combination, it is evident that it can be only a molecular motion which produces the electrical effects.

Gases, in their reaction on water, likewise give rise to electrical effects subject to the same laws. To be convinced of this, it is sufficient to take two sheets of platinum, connected with a multiplier, covered one with oxygen, the other with hydrogen, and to dip them simultaneously into water. A current is immediately manifested whose direction indicates that the first takes from the water positive, and the second negative, electricity. The effects are also the same when only one of the two plates is covered with oxygen or hydrogen.

The phenomena of combustion make no exception to the general rule.

It is evident that chemical actions of whatever nature produce, at the moment of their being exerted, electrical effects subject to simple laws, against which some objections have been made which I shall prove further on to be unfounded.

To return to Ampère's theory, which was favourably received at the time of its enunciation, but which by no means satisfies the requirements of science. The acids, I have already said, are eminently negative bodies, surrounded by atmospheres of contrary electricity, from which they are freed at the moment they enter into combination, to take it again from the surrounding bodies when the combination is destroyed, whence result, in both cases, inverted electrical effects. The alkalis give rise to opposite effects.

This hypothesis explains much better than that of Berzelius the electrical effects observed in chemical actions, as well as the permanence of the contact of the atoms so long as the combination lasts, since this is the consequence of the reciprocal attraction of the two contrary electricities proper to the atoms; but we must go no further. Indeed, if acids are always electro-negative and alkalis always electro-positive, and if the contact of the atoms in the combination be due to the attractive action of two contrary electricities, why, as we have so many examples, do certain acids behave like alkalis to other acids, and thus become electro-positive? Why does an alkali or an oxide likewise act as an acid towards another oxide, so as to become electro-negative, although electro-positive at first? Ampère, to solve this difficulty, supposed that atoms, independent of their own electricity, also possess, like all other bodies, a certain portion of natural electricity, by means of which effects are produced similar to those observed when we put together two bodies very unequally charged with the same kind of electricity: in this case the repulsion is converted into attraction. The difficulty may be solved by adopting the electrical polarity of Berzelius; but again suppositions, again hypotheses, to explain phenomena which depend probably on very simple causes! Let us put away these theories, and devote ourselves to studying absolute facts and the consequences which flow from them.

The decompositions by means of the pile also throw some light on the electrical state of atoms in combination, since they teach us that affinities are destroyed by electrical forces, that the action of the latter is definite, and that a substance can be transported to one of the poles only inasmuch as it is combined with another substance having a tendency to go to the other pole,—phenomena which indicate that the electrical state of atoms is only disguised in the combinations, as Ampère thought, or else that it is the result of an action by influence on the part of the electricity in motion in one as in the other case; it is evident that, if electrical forces do not constitute affinities, these two kinds of force have, nevertheless, such relations with each other that the second may be weakened, destroyed, or augmented by the first.

This property of electricity in motion of acting on a substance in solution only when it is combined with another substance, having a tendency to pass to the other pole, gives evidence of dualism, or the mode of combination by antagonism. If this mode of combination did, indeed, exist, how would the electro-chemical decompositions of organic or inorganic compounds always present the peculiarity of being effected in two distinct parts, possessing opposite properties, and which, united by affinities or electrical forces, where there was no formation or secondary products, reproduce those same compounds? If we continue to explain the relations which connect these two kinds of forces,

we see that the chemical action of the current is definite, in that even the equivalents of bodies are associated with equal quantities of electricity, and that the influence of masses is exerted in electro-chemical decomposition, as in ordinary chemical actions. If we passed an electric eurrent into a mixture of two saline solutions, according to their proportions and the intensity of the current, the salt whose elements aie united by virtue of the lowest affinities is entirely or partly decomposed, whilst the other salt is not at all affected, or only partially so.

If we had the means of estimating with great accuracy the quantity of electricity which appears to be associated with atoms in combinations, which is necessarily equal to that which the pile must put in motion to operate their separation, we might compare the affinities with each other with regard to temperatures, the influence of masses, &c.

In the considerations which I have just presented I have said that there is a disengagement of electricity in the contact of two bodies only when there is a chemical action, difference of temperature, or mechanical or molecular action, whence I have concluded, as De la Rive had formerly done, that the equilibrium of electrical forces is disturbed only when matter is put in motion by any eause whatever. The effects of static eleetricity which take place on the contact of gold and platinum were opposed to this general rule. But these effects, as Edmund Becquerel has demonstrated, are not due to the simple contact of these two metals; indeed, if two plates of a condenser, one of platinum, the other of gold, be placed over one another, then put in communication by means of a galvanic eircuit, a eharge of eleetricity is always obtained; the platinum is negative and the gold positive. On submitting a plate of zinc to the plate of gold, the platinum is still negative; but if, instead of establishing the communication with a metallie arc, it be made with the fingers moistened, we have inverted effects.

According to De la Rive, platinum, in being very slowly oxidized, is thus found in a negative state. He bases his opinion in this respect on the fact that electrical effeets diminish in proportion as the layer of varnish, which prevents the air from acting so strongly on this metal, is augmented.

[*To be continued.*]

OBSERVATIONS ON THE PREPARATION OF MINERAL KERMES.

By T. DEROUEN.

The author has published an extensive treatise on kermes, its preparation, and especially its production in a uniform state. It contains no analyses to ascertain the composition of this substance, which has been already so frequently examined. Its object is rather to diseover the eircumstances under which a kermes may be obtained with certainty, free from oxide of antimony and alkaline sulphuret. The first admixture can now, as Rose has shown, be avoided; but with respect to the latter, the author is of opinion that none of the officinal kermes up to the present time has been free from it.

The methods recommended for the preparation of kermes are, including the older ones, for instance those of Lemerey and La Ligerie, essentially of three kinds:—1st, sulphuret of antimony is boiled with carbonate of potash or soda; 2d, caustie alkali is substituted for the carbonate in 1; 3d, a mixture of sulphuret of antimony and carbonated alkali is fused at a red heat, and the fused mass treated with boiling water. The author prepared kermes:—

A. *According to the Recipe of Cluzel.*—20 grms. of finely-pulverized sulphuret of antimony and 200 grms. of carbonate of soda were boiled with 4 quarts of water for two hours in a cast-iron vessel. 9.5 grms. of kermes of a beautiful velvety colour were obtained.

B. *According to the Recipe of Beaumé.*—30 grms. sulphuret of antimony were fused with 60 grms. carbonate of potash and 2 grms. of sulphur. Of the mass so obtained, 47 grms., which contain just as much sulphate of antimony as the preceding mixture, were boiled for two hours with 4 quarts of water. 18.10 grms. kermes were obtained, but of a less beautiful colour than according to Cluzel's method.

C. *According to Berzelius.*—30 grms. of sulphuret of antimony were fused with 80 grms. of carbonate of potash, and 56 grms. of the mass obtained exhausted with boiling water. 11 grms. kermes, of a very beautiful but not velvety appearance, were obtained.

D. *According to Thierry.*—30 grms. sulphuret of antimony and 10 grms. dry carbonate of soda were fused together, and two thirds of it boiled for two hours with 4 quarts of water which contained 4 grms. carbonate of potash. The precipitate which was deposited had a bad colour, and was in sueh a fine state of division that it passed through the filter. Only 2.05 grms. could be collected.

E. *According to Liance.*—This process appears to be derived from some old Pharmacopœia, and consists of two operations:—

I. 500 grms. of cowhair and 1 kilogramme of potash are placed in alternate layers in a erucible, which is then covered, and the mass fused until no more gas is disengaged.

II. 15 kilogrms. of sulphuret of antimony, 8 kilogrms. carbonate of potash, and 50 litres of river-water are then taken, and the sulphuret of antimony broken into long pieces and boiled with the 50 litres of water in an iron pan. 2 kilogrms. of potash are then added to it, and afterwards a quarter of the preparation I. It is then boiled for an hour, filtered into a hot dish, and the liquid poured whilst hot into two warm cylindrical vessels, which are well covered and left to stand till the following day. The pan is again filled with water and 1 kilogrm. of earbonate of potash, and the second fourth of the preparation I. added. The same operations have to be gone through as above, only that the liquid obtained is poured into two fresh eylindrical vessels. This is repeated until all the four fourths of the preparation I. are consumed. We have now eight vessels. The alkaline liquid is poured from the two first upon the sulphuret of antimony in the pan, which is again filled with water, and the operation previously described repeated. The same is done with the other vessels in succession. This can be continued for a month if the sulphuret of antimony is well stirred, and 1 kilogramme of potash is added about every six days to each liquid of the four series. The deposits from the different vessels are collected daily, and thrown upon a linen strainer, which is covered with bibulous paper. They are washed with hot water, and dried with exclusion of the light between 59° and 64°. Kermes which has been prepared according to this method is in so far remarkable as part of that which is met with in the commerce of Paris is obtained in this manner. Samples which the author prepared according to the above directions were not so beautiful in eolour as that obtained aceording to Cluzel's process; moreover, the produce was much smaller. These samples, however, exhibited no difference on eomparison with kermes prepared by M. Liance himself. That chemist asserts that kermes prepared according to his directions is of constant eomposition; but this is contradicted by the fact that he himself furnishes a kermes No. I. and II., and likewise that more or less oxide of antimony must be precipitated in proportion to the time the precipitate was left in contact with the liquid.

With regard to the employment of cowhair in this process, this can only produce a quantity of eaustic potash, sulphuret and cyanide of potassium. The author has examined the product, and found that so little eyanide of potassium is formed that the whole effect must be ascribed to the sulphuret of potassium alone, and, consequently, the hair may be replaced by an addition of sulphur. From an analysis of cowhair it was found that 2 grms. contained 0,064 grm. sulphur. If we calculate accordingly the quantity of sulphur corresponding to the weight of cowhair, the disagreeable operation of fusing it with potash can be avoided. A kermes is obtained which cannot be distinguished from that prepared strictly according to the directions of M. Liance.

Under all circumstances where kermes is produced, it is always formed by the reciprocal action of sulphuret of antimony and an alkali; in this operation there is principally formed hydrated sulphuret of antimony, but at the same time, as a secondary product, oxide of antimony; and a certain amount of alkaline sulphuret always adheres to the sulphuret of antimony, which cannot be removed by washing, whilst the oxide of antimony is held in solution by a large excess of potash.

According to the author's view, kermes is formed in this manner:—On the first action of the sulphuret of antimony upon the carbonate of potash or soda, or on caustic alkali, a sulphuret of the alkali is formed, which then again unites with the sulphuret of antimony, forming a sulphosalt, SbS_3, KS or SbS_3, NaS, in which the sulphuret of antimony acts the part of an acid. This salt, which is very soluble in water, is decomposed by the weakest acid, even by the carbonie acid of the atmosphere. It converts the double sulpho-salt into carbonate and hydrated sulphuret of antimony. Carbonic acid, however, expels only half of the sulphur or of the sulphuretted hydrogen which the monosulphurets or the hydrosulphates contain; and it is owing to this cause that in all the above methods so little kermes is obtained, by far the greater portion being left in the mother ley.

The author now prepared the sulpho-salt directly by boiling for two hours 20 grms. of sulphuret of antimony with a solution of the monosulphuret of sodium, prepared with 40 grms. of caustic soda in 1 litre of water. The liquid, on gradually cooling, left not a trace of a precipitate. Into this solution sulphuretted hydrogen was passed, when a bulky precipitate, weighing 4.5 grms., was obtained.

In a perfectly similar experimeut with monosulphuret of potassium, employing a quantity of potash equivalent to the above amount of soda (60), there were obtained 5.47 grms. kermes.

The author thence eoncludes that in the preparation of kermes a double sulphuret of antimony and an alkali are first produced, which then, by further decomposition in the air, furnishes carbonated alkali and sulphuret of antimony. To demonstrate this by further experiments, 20 grms. of sulphuret of antimony were boiled for a whole day with a solution of hydrosulphuret of potassium, KS, HS, prepared with 60 grms. of potash, replacing every now and then the evaporated water. Not a trace of kermes was formed, and the sulphuret of antimony did not decrease in weight. It is evident, therefore, that the sulphuret of antimony, SbS_3, really acts the part of an acid, since it combines with KS or NaS, but not with the hydrosulphurets KS, HS or NaS, HS, in which sulphosalts the sulphuretted hydrogen occupies the place of the sulphuret of antimony, and is a more strongly negative body, since the sulphuret of antimony may be separated by it from the combinations KS, SbS_3 or NaS, SbS_3.

The kermes prepared with the alkaline monosulphurets does not possess a beautiful colour; it may easily be obtained free from oxide of antimony when the alkaline sulphuret is correctly prepared; but it is difficult to free it from sulphuret of potassium or sulphuret of sodium, which adhere tenaciously to it. The author, however, succeeded in procuring a kermes containing scarcely one half per cent. of alkali by the following process:—The kermes, prepared as above directed with sulphuret of sodium, was frequently washed with hot water, and then transferred to a tall displacement apparatus. A mixture of equal parts of boiling alcohol and water was poured upon it, the upper part of the apparatus closed with a cork, and a current of sulphuretted hydrogen passed for a quarter of

an hour into the mixture. As soon as the liquid had drained off, boiling alcohol was poured upon it, with the precaution that no air could enter the apparatus. This operation was repeated for several hours, when the apparatus was set aside for the kermes to deposit. It was washed and dried.

The kermes was of a chesnut-brown colour, had no velvety appearance, appeared under the microscope to be free from crystals of oxide of antimony, and furnished, after treatment with muriatic acid, a liquid which deposited mere traces of chloride of sodium.

According to H. Rose, kermes, when free from oxide of antimony, furnishes a black mass when fused in a current of carbonic acid, the powder of which is likewise black. Kermes containing oxide of antimony may also be black after fusion, but the powder is brown or red. The different preparations treated of in this paper all fused to a more or less black mass; but that prepared according to Beaumé and Thierry gave a brown powder; that according to Berzelius a brown powder with a reddish tint; that according to Cluzel a blackish-brown powder; that according to Liance a very readily fusible mass and red powder; and that prepared according to the author's method a beautiful black powder. It is evident, therefore, that:—

1. Kermes is obtained according to Cluzel's method of a beautiful colour and tolerably pure. In the last respect it is only inferior to that prepared with monosulphuret.

2. A kermes with a colour nearly as beautiful is obtained according to the methods of Beaumé and Berzelius, but it contains a large amount of oxide of antimony; this method is otherwise the quickest for preparing kermes.

3. The preparation by means of monosulphurets furnishes the purest kermes; but it cannot be carried out on a great scale for commercial purposes.

4. Under all circumstances the moist way must be adopted and a large excess of alkali used, in order to obtain a kermes free from oxide of antimony.

5. Those pharmaceutists who adopt the process of M. Liance may substitute a corresponding amount of sulphur for the cowhair.

6. In all cases where kermes is formed there must first be produced a double sulphuret of alkali and antimony, which is decomposed by weak acids, for instance the carbonic acid of the atmosphere, into carbonated alkali and kermes. The various kinds of kermes met with in commerce have all a very variable composition.—*Journ. de Pharm. et de Chim.*, xv., p. 5.

ON THE ADULTERATION OF KERMES.

By M. BUSSY.

In the "Journal de Pharmacie" for October the author draws attention to the fact that during this year's visitation the kermes was found at a large number of chemists and druggists in Paris to consist almost entirely of peroxide of iron. This adulteration is easily detected. About a gramme of the suspected kermes is heated in a small flask with five or six cubic centimetres of pure concentrated hydrochloric acid. Pure kermes dissolves with a considerable disengagement of sulphuretted hydrogen; the liquid is colourless, milky, and deposits a little sulphur; it is heated to boiling, in order to expel the sulphuretted hydrogen, and filtered; the liquid should pass through colourless. If the kermes contain peroxide of iron the proportion of sulphuretted hydrogen is less considerable, sometimes scarcely perceptible. The deposit of sulphur is very copious, and the filtered liquid, instead of being colourless, is of a more or less deep yellow, according to the amount of iron it contains. In all cases the liquid is mixed with a little of a concentrated solution of tartaric acid, to prevent the precipitation of antimony, and then diluted with water; a little prussiate of potash is then added, which instantly produces a very copious blue precipitate if the kermes contain iron.—*Chem. Gaz.*

CONTRIBUTIONS TO THE CHEMISTRY OF THE METALS OF PLATINA.

By M. C. CLAUS.

On examining the residuum of the treatment of platina by its solvent, the author had an opportunity of observing several reactions occurring between the metals of platina and their combinations which had not been remarked, but which appeared to him worthy of attention. The following is a sketch of these reactions:—

1. *Chloride of Iridium and Nitrate of Silver.*—It is well known that the chlorine of the solutions of the various platina metals is not precipitated as pure chloride of silver by the nitrate. In employing chloride of iridium a compound is also obtained, which, according to the author, is an argento-sesquichloride of iridium, insoluble in water or in acids, and difficultly soluble in ammonia, but from which it may always be obtained in the form of rhomboids, as brilliant as diamonds. M. Claus analyzed this salt, and found it to correspond to the formula $3\,AgCl, +Ir_2Cl_3$.

2. *Action of Sulphuric Acid and Sulphite of Potash on the Chloride and Double Compounds of some of the Platina Metals.*—Sulphurous acid reduces the higher chlorides of the platina metals to a lower degree; the chloride of platina into protochloride, and the chloride of iridium to sesquichloride, &c. As to the double salts of these chlorides, sulphite of potash gives with them a series of compounds of peculiar composition which contain sulphurous acid, communicating to them properties which are quite peculiar.

a. Compounds of Iridium.—When, for the preparation of potassio-sesquichloride of iridium, eight parts of water are poured upon potassio-chloride of iridium in fine powder, and sulphurous acid is passed through the liquor till an olive-coloured solution is formed, the chloride is converted into sesquichloride, accompaned with the formation of sulphurous and hydrochloric acids. This salt, the composition of which is represented by $3K\,Cl + Ir_2\,Cl_3 + 6Aq$, effloresces readily in warm dry air; it is opaque, and its crystals become covered with a bright green powder. It is insoluble in alcohol, soluble in water, forming an olive-green solution, but by transmitted light it is slightly purple. It has the bitter taste of chloride of iridium; but it is more permanent, and the solution may be evaporated nearly to dryness without decomposition. The alkalis decompose it with difficulty. Aqua regia converts it readily into chloride, and nitrate of silver immediately precipitates, without any blue reaction, the double salt $3AgCl + Ir_2Cl_3$.

The solution of potassio-chloride of iridium, reduced by sulphurous acid, and from which the greater part of the sesquichloride may be precipitated by carbonate of potash, preserves its olive-green colour at common temperatures; but if it be heated it passes after some time to a red colour, and eventually to a bright yellow.

It forms also several compounds of peculiar composition, which contain sulphurous acid, and which, when mixed together, may be separated, some in the crystalline form and others in that of powder, by evaporations which are of difficult execution. The author succeeded in isolating three:—1. A rose-coloured crystalline salt; 2. An amber-coloured substance, having the consistence of Venice turpentine; 3. A white pulverulent compound. All these compounds contain potash, sulphuric acid, chlorine, and protoxide of iridium in variable proportions. They are nearly insipid, and very slightly soluble in water, disengage sulphurous acid when heated, and are difficultly decomposed by calcination.

Hydrochloric acid dissolves them readily, disengaging part of their sulphurous acid, and converting them into other salts containing an equivalent of chlorine. The aqueous solution gives a white flocculent precipitate with chloride of barium, and the alkalis decompose them with difficulty. They are but slowly oxidized by means of aqua regia; and before conversion into chloride of iridium they assume a deep cherry-red colour.

The author has analyzed the rose-coloured salt, and finds the composition to be represented by:—

$$(2KO, SO_2 + 2KCl) + (2IrO \left\{ \begin{matrix} 2SO_2 \\ Cl \end{matrix} \right\}.$$

The amber-coloured substance resembling turpentine M. Claus has also analyzed, and gives as its rational formula:—

$$4KO,\ SO_2 + 2IrO + \left\{ \begin{matrix} 2SO_2 \\ Cl \end{matrix} \right\}.$$

The white salt of iridium, obtained only in small quantity, has been described and analyzed by the author; its formula is:—

$$3KO, SO_2 + IrO_2, SO_2 + 5Aq.$$

On treating this salt with hydrochloric acid a yellow solution is obtained, which by evaporation yields yellow prisms, considered by M. Claus as a double salt, or sulphite of protoxide of iridium and chloride of potassium, $3KCl + IrO_2, SO_2$.

b. Compounds of Osmium.—The potassio-chloride of osmium undergoes no modification by sulphurous acid at common temperatures; but, when heated, sulphite of potash occasions a partial decomposition, producing a pulverulent precipitate, which is a double sulphite of potash and osmium, represented by the formula $3KO, SO_2 + Os\,O_2, SO_2 + 5Aq$. On treating this salt with hydrochloric acid, the double salt, $3K\,Cl + Os\,O_2, SO_2$, or chloride of potassium and sulphite of osmium.

c. Compounds of Platina.—The author describes in a few words the preparation of potassio-chloride of platina, which, heated with sulphite of potash, serves for the preparation of a white substance, which the author from his analyses considers as a double sulphite of potash and platina, $3KO, SO_2 + Pt\,O_2, SO_2 + 2\frac{1}{2}Aq.$; it resembles the salt of osmium, but is more insoluble, almost insipid, heavier, and contains only half the quantity of water. With hydrochloric acid it acts differently from the preceding salts; for it loses all its sulphurous acid, and is converted into potassio-chloride of platina.

d. Compounds of Ruthenium.—Sulphurous acid acts but little upon the potassio-sesquichloride of ruthenium at common temperatures; but a solution of the salt treated with sulphite of potash becomes of a deeper red colour, and a pulverulent isabella-yellow precipitate separates from the liquor. This substance, by repeated solution and crystallization, is obtained of a white colour; and the author is of opinion that it has the same composition as the other salts obtained from the other platina metals; but the small quantity of ruthenium which he had at his disposal prevented him from verifying.—*L'Institut*, August 1, 1849.

DETECTION OF SMALL QUANTITIES OF IODINE.

By M. L. THOREL.

The method employed by the author for this purpose is the following, and is merely a modified method of using starch. Put into a small phial fifty or sixty grammes of the suspected liquor, or, if it be a solid body, diffuse it in a small quantity of water; add six drops of pure nitric acid, and the same quantity of hydrochloric acid; a small piece of paper is then to be covered with a rather liquid preparation of starch and placed at the mouth of the phial, which is to be heated. If the liquor contains iodine, either in a state of iodide or iodate, the paper will assume a violet blue of greater or less intensity. The nitric acid sets the iodine free by decomposing the iodides, if any exist; the effect of the hydrochloric acid is, that it is substituted for the iodine, by decomposing the iodate, if it should be present.

If the paper should not become coloured at the moment of ebullition, the same quantity of the two acids should be added, shaking the phial strongly. In an instant the spots should appear, and the stratum of iodine will gradually increase. It

must not be immediately concluded that no iodine is present if no colour appears, for it is separated with difficulty from certain bodies, as happens with molasses. In such cases a second operation must be performed, adding to the liquor ten to twenty centigrammes of tartrate of potash dissolved in a small proportion of water. Heat is to be applied an instant before addition of the acids, which on this occasion may be used in the proportion of eight to ten drops of nitric acid, and four drops of hydrochloric acid. After this trial an opinion may be arrived at with great certainty.

By operating in this manner, the presence of iodine may be detected in a mixture which contains only three to four milligrammes. With a mixture of twenty milligrammes of iodine and 200 grammes of salt, very intense spots may be obtained.—*Journ. de Chém. Méd.*, Septembre, 1849.

ON THE COMPOUNDS OF THE HALOGENS WITH PHOSPHORUS.

By J. H. GLADSTONE, Ph.D.

[*Concluded from page* 290.]

Sulpho-bromine Compound.— On passing a stream of hydrosulphuric acid over pentabromide of phosphorus, combination instantly ensued; the yellow crystals gave place to a colourless or slightly red liquid, whilst hydrobromic acid was evolved; no free bromine or bromide of sulphur was observed. When the action was complete, the new product was first heated in a water-bath to drive off excess of hydrosulphuric acid, and then distilled at about 200° C. A colourless dense liquid passed over; but analysis showed that it was not the sulphobromide expected. The estimations, Nos. 1 and 2, recorded below, were made from it. Fearing that a decomposition might have taken place in the distillation of this substance, I submitted some carefully-prepared pentabromide of phosphorus to the action of dry hydrosulphuric acid, and examined the resulting liquid itself. It was colourless or slightly red, of high specific gravity, and fumed in moist air, giving forth a disgusting and delcterious odour. It was slowly decomposed by water, sulphur being deposited; and hydrobromic and phosphorous acids being dissolved: there was also in solution a sulphide of phosphorus, which gave a brown precipitate with a silver salt, but no hydrosulphuric acid. If alkali were added to the water, decomposition took place much more rapidly. It was soluble in ether, insoluble in cold sulphuric acid; but upon raising the temperature to about the boiling-point of the substance decomposition ensued, the sulphuric acid became red, hydrobromic acid was evolved, and afterwards bromide of sulphur. Strong nitric acid attacked it violently; the phosphorus and sulphur being oxidized, the bromine dissipated. When treated with bromine, it gave momentarily the yellow crystals of pentabromide of phosphorus; then gas was evolved, and it again became liquid. It boiled at about 200° C. without alteration. The quantitative estimation of its elements gave analysis No. 3, proving its identity with the liquid first analyzed.

As the hydrosulphuric acid employed in these experiments was made from sulphide of iron, and was dried by passing through sulphuric acid, I suspected that free hydrogen might possibly have interfered with the reaction, although it does not affect pentabromide of phosphorus itself when alone. The experiment was therefore repeated with hydrosulphuric acid prepared from sulphide of antimony, and dried by means of chloride of calcium. When the resulting colourless liquid was thoroughly saturated with the gas, it was found to be similar to that previously obtained. It afforded analysis No. 4.

The analyses numbered 1, 3, and 4 were performed by oxidizing the liquid by means of nitric acid. The second analysis was obtained by allowing the liquid to remain under water until entirely decomposed, precipitating the bromine by nitrate of silver, heating the precipitate with nitric acid in order to destroy the brown salt produced at the same time, estimating the sulphuric acid thus formed in the usual manner, and adding the amount of sulphur it contained to that left undissolved in the aqueous solution.

I. 0.200 grm. of the liquid yielded 0.075 grm. of sulphate of baryta, and 0.0702 grm. of phosphoric acid.

II. 0.373 grm. yielded 0.07255 grm. of bromide of silver, 0.0125 of sulphur, and 0.045 grm. of sulphate of baryta.

III. 0.4445 grm. yielded 0.173 grm. of sulphate of baryta, and 0.136 grm. of phosphoric acid.

IV. 0.2965 grm. yielded 0.124 grm. of sulphate of baryta, and 0.0848 grm. of phosphoric acid.

Or, reckoned to 100 parts:—

	I.	II.	III.	IV.
Phosphorus	15.6	..	13.6	12.8
Bromine	..	81.6		
Sulphur	5.2	5.0	5.4	5.7

This does not accord well with any simple formula. If we suppose it to be a chemical combination of three atoms of terbromide with one atom of tersulphide of phosphorus, *i.e.*, a sulphophosphite of the bromide of phosphorus, we obtain numbers which are similar:—

	Calculated from $3PBr_3 + PS_3$.
Phosphorus	14.5
Bromine	80.1
Sulphur	5.4
	100.0

It is possibly, however, a mixture of two distinct substances having nearly the same boiling-point.

It does not appear that similar compounds belonging to the iodine series exist. Pentiodide of phosphorus is rapidly decomposed by the moisture of the atmosphere, but it did not furnish an oxyiodide. Hydrosulphuric acid has no action on the pentiodide of phosphorus, either at the ordinary temperature, or when fused by the heat of a water-bath.

It is remarkable to observe the increased stability which these two atoms of oxygen, or sulphur, give to the compound of phosphorus with three atoms of the halogen. Whereas hydrosulphuric acid is capable of completely decomposing both the terchloride and terbromide of phosphorus, it is incapable of removing the three atoms of chlorine from the sulphochloride of phosphorus, and also the remaining bromine from the compound of bromine, sulphur, and phosphorus just described. Again, whilst metals immersed in terchloride of phosphorus, or terbromide, are attacked by them, they remain unaltered in oxychloride or oxybromide of phosphorus, or the sulpho-bromine compound. Even potassium, which instantly inflames with violence when brought into contact with terchloride of phosphorus, will remain quite unaffected in the oxychloride, and combination is not determined even by boiling the liquid. It is true, the less easily oxidized metals, such as silver or platinum, are not attacked by terchloride of phosphorus at any temperature; but even platinum is acted upon by the pentachloride with the assistance of heat, the compound being entirely decomposed. And lastly, whereas the penta-compounds of the halogens with phosphorus may be reduced by means of additional phosphorus, no such reduction of the oxychloride takes place. This substance is also unaffected by iodine, bromine, or chlorine.

There appears no reason why a compound of phosphorus might not be formed, in which two of the halogens should be associated; but all my attempts to procure such a body have proved unavailing. Many of the experiments given above were undertaken with that view. It occurred to me, also, that since chlorine decomposes both the pentabromide and iodide of phosphorus, hydrochloric acid might possibly effect a partial double decomposition; but I found it had no action upon either. If chloride of mercury and pentiodide of phosphorus be heated together, double decomposition does ensue; but it extends to the three atoms more intimately connected with the phosphorus, and the two additional atoms of iodine are set free; thus:—

$$PI_5 + 3Hg\,Cl = P\,Cl_3 + 3HgI + 2I.$$

Since a halogen, bromine for instance, combines directly with the ter-compound of the same halogen with phosphorus, it appeared not improbable that it might combine readily with another ter-compound. But, when bromine is poured upon the terchloride of phosphorus, it merely sinks to the bottom, and the two liquids cannot be made to mix. If, however, a little iodine be added, a junction is instantly effected, attended with great evolution of heat: when the temperature falls, a red crystalline mass separates, resembling pentabromide of phosphorus when prepared with excess of bromine. In order to prove whether it was really this substance, or some new compound, it was necessary to separate it if possible from the accompanying liquid. This could not be effected by distillation, and the action of solvents was destructive: purely mechanical means, therefore, had to be resorted to. A compound of bromine and iodine was prepared, and terchloride of phosphorus was allowed to fall into it, drop by drop, as long as the crystals appeared to increase in quantity; the supernatant liquid was then poured off, and the crystals were allowed to drain, without free exposure to the atmosphere, and were afterwards transferred to a porous tile also protected from moist air. When they appeared as dry as they were likely to become, they were analyzed through decomposition by water, and precipitation of the hydracids by nitrate of silver.

0.431 grm. of the red crystals yielded 0.910 grm. of bromide of silver, and 0.113 grm. of chloride of silver.

This indicates 88.6 per cent. of bromine, and 6.4 per cent. of chlorine. Evidently, therefore, the crystalline body was no combination of both halogens with phosphorus, but merely pentabromide of phosphorus contaminated with a little of some chlorinated compound. The pentabromide requires 92.45 per cent. of bromine, and 7.55 per cent. of phosphorus. The reaction that takes place is in all probability very simple:—

$$PCl_3 + IBr_5 = PBr_5 + ICl_3.$$

If iodine be added to the terchloride of phosphorus, a red solution is immediately obtained. If this be subjected to a temperature a little below 100° C., a red liquid distils over. Quantitative analysis showed that this was merely a solution of iodine in the terchloride; that element having passed over, in considerable quantity, with the vapour of the compound, at a temperature far below its own subliming point. In the same manner, if iodine be added to the terbromide of phosphorus, a red liquid is obtained, but without chemical combination.

Nor does it appear that direct combination will take place between phosphorus and the compounds of the halogens themselves. When the liquid chlorine of iodine is added to phosphorus, violent combination ensues; iodine is liberated; and, even if a double compound be at all formed (which I doubt), it is destroyed by heat, and resolved into chloride of phosphorus and iodine. Again, if phosphorus be brought into contact with the orange-yellow crystals of terchloride of iodine, a blue colour is instantly developed, as though from the liberation of iodine, and a result is obtained similar to that in the former experiment.

Before quitting the compounds of bromine and phosphorus I must mention a crystalline body, which I frequently obtained during my investigation of them, but which, from not understanding the conditions of its formation, I have never procured in any considerable quantity; and, in the attempt to purify it, I have almost uniformly destroyed the little I did possess. In distilling terbromide or oxybromide of phosphorus, there remained in the retort, on several occasions, a small amount of these crystals; and they were observed to form on the yellow pentabromide of phosphorus, when imperfectly secured from the action of the atmosphere, but

before complete conversion into oxybromide. They are perfectly transparent and colourless, with sharply-defined edges; they are decomposed by water: by the moderated heat of a spirit-lamp they fuse, and immediately sublime. But this fusion is apt to produce an alteration in them: instead of recrystallizing on cooling, a permanent liquid is sometimes found, having the characters of oxybromide of phosphorus. The only analysis I obtained was made with a very small quantity.

0.1125 grm. yielded 0.2255 grm. of bromide of silver, and 0.048 of phosphate of magnesia.

Or, reckoned to 100 parts:—

Phosphorus	12.0
Bromine	84.2
Oxygen, or loss	3.8
	100.0

Is this crystalline body isomeric with liquid oxybromide of phosphorus? or is it some compound containing less oxygen? May it not also possibly account for the variations in the boiling-point of the oxybromide.

We are unacquainted, I believe, with any method by which the iodides of phosphorus can be purified from excess of iodine. Thus they have never been analyzed. It is on this account, also, that my researches have not been carried so far with the iodine as with the bromine compounds; nor can I feel perfect confidence in all the results at which I have arrived in reference to them.

Thus have we seen the manner in which the halogens combine with phosphorus, forming ter and penta compounds; and also some methods by which the compounds containing five atoms of the halogen may be reduced to those containing three. The comparative feebleness of the combination of the two additional atoms has been rendered still more evident by the action of certain elementary bodies, and of the compounds of these elements with hydrogen. Among the products of these reactions are an oxybromide of phosphorus, and a sulphur compound of less simple formula. It has also been remarked how the substitution of oxygen, or sulphur, for two of the elements of halogen in a penta-compound, increases the force with which the remaining three are combined. And, lastly, the great indisposition of any two halogens to enter together into a phosphorus compound has likewise been observed.

THE NATURAL HISTORY OF THE CINCHONAS.*

In 1843 M. de Castelnau, having been commissioned by the French Government to undertake a scientific expedition into the interior of the provinces of Brazil and Peru, the Museum of Natural History of Paris appointed M. Weddell to join the expedition, with special instructions to investigate several important botanical subjects and other branches of natural history. After conjointly prosecuting these investigations for two years, M. Weddell separated from M. de Castelnau on the confines of Mattogrosso, in order to pursue his researches in another direction, and these researches he continued until 1848. The question of the cinchonas, which has been so much discussed, and is still so obscure, particularly fixed the attention of M. Weddell. It was with reference to this object that his course was principally directed, and the results of his laborious researches form the subject of the work alluded to in this paper. This important work, which when finished will form a magnificent folio volume with numerous engravings, appeared to us so important in a pharmaceutical point of view that we did not wait its completion before giving some account of it. M. Weddell with much kindness having placed at our disposal the first sheets of his work, we have extracted some details, which will indicate the general character of the work, and will excite much interest in the talented young man whose zeal, intelligence, and courage have accomplished so much.

Since the time of Condamine, who was the first to describe the cinchonas in Europe, until the illustrious travellers Humboldt and Bonpland, to whom we are indebted for the earliest accounts of the geography of this class of plants, a number of learned men of all countries have made this the object of their researches; and a catalogue alone of the works published on this subject would occupy many pages. But only a small number of those who have described the cinchonas have studied them in their native country, and it is the observations of these few which have furnished matter for the greater part of the other writers.

The origin of the bark of the cinchona was for a long time a mystery. It was Condamine who first threw any light on the subject, and to this further additions were but slowly made. Joseph de Jussieu, in 1735, accompanied as botanist the commission of the Academy of Sciences sent to measure a degree of the meridian under the equator. He visited about the same time as the celebrated astronomer the cinchona forests of Loxa, those of High Peru, and almost penetrated into the frontier of Brazil. A succession of unfortunate accidents prevented the publication of the results of his researches. He did not return to Europe until 1771, after an absence of thirty-six years, and was then deprived of his reason.

Thirty years later two expeditions were engaged to explore the cinchona regions in Lower Peru and New Granada, the one directed by the celebrated Mutis, the other by Ruiz and Pavon. The immense investigations of these naturalists did not advance the history of these plants as much as might have been expected. Since the observations of Messrs. Humboldt and Bonpland, who visited the same country subsequently, the region from which the cinchonas are exported has been greatly increased, in consequence of the discovery of new districts, and commerce has been enriched by several new species.

Previously to the year 1775 Loxa bark was the only kind of cinchona known in commerce. It was not until 1772 that Mutis discovered the valuable tree in the neighbourhood of Santa Fé de Bogota, and at this period Europe began to receive cinchonas direct from the ports of New Granada on the Atlantic. Some years later the authors of "Flora Peruviana" studied the species of Lower Peru, to the north of Lima, and these also were introduced into commerce. The only species then which, botanically speaking, still remained unknown in Europe were those growing in the vast extent of country extending southward. Notwithstanding the efforts of Joseph de Jussieu and the botanist, Taddaeus Haenke, little was added to the scientific knowledge of the cinchonas by their travels. The object of M. Weddell's work is to make known the species which have come under his observation in these regions during the years 1845, 46, 47. The immense commercial demands on the cinchonas of these parts, tending to exhaust the forests, rendered it neceesary that new sources should be discovered. At a period when the consumption of these barks was becoming more and more considerable it was desirable that attention should be directed to those cinchonas which will have to replace the Calisaya bark, the supplies of which are becoming less abundant. These species, although they may be less rich in active principles, yet from their abundance offer some security against the prospect of our being deprived of one of the most valuable medicines of the vegetable kingdom.

M. Weddell penetrated into Bolivia in the month of August, 1845, through the country of the Chiquito Indians. The formation of the country in this province is quite incompatible with the existence of the true cinchonas. The greater part of its surface is so low and flat that during the rainy season it is completely inundated. In the month of November he journeyed towards the south, gained the Rio Grande, and crossed the country of the Cordillera as far as Tarija, where he arrived in January, 1846,—a laborious journey, the object of which was to determine with correctness the southern limit of the district of the cinchonas. M. Weddell gave the name of Cinchona Australis to a species which he discovered, like a distant sentry, at this extreme point, near to the nineteenth parallel of south latitude. In the month of August following he visited some of the large towns of Bolivia. At Cochamba a curious phase of his expedition began. He traversed near there the great chain of the Andes, purposing to reach La Paz, where the cinchona commerce is carried on to the greatest extent. The Andes present at this part a long and fine series of natural steps, by which the traveller gradually descends, passing successively in review all the varieties of climate and all the corresponding shades of vegetation. The different species of cinchona are rapidly presented to observation. Almost immediately on his entering the province of Enquisivare he had the opportunity of studying the trees which produce the Calisaya bark, the most valuable of all the species, in consequence of the large proportion of quinine which it contains. He gave to this tree, previously unknown, the name of Cinchona calisaya. At Palca he learned that there was recently discovered, on the borders of the Rio Ayopaya, an immense forest of cinchonas which no one had yet explored. But it was in the province of Yungas, the richest and most fertile of the provinces of Bolivia, that he obtained the most precise information of the mode of procuring, preparing, selling, and adulterating the barks which he wished to study.

In 1847, after the rainy season, M. Weddell resumed the road of the Great Cordillera. The town of Sorata, or Esquibel, situated on the eastern side of the Andes, and at the foot of one of its highest peaks, is considered one of the most prolific sources of the Bolivian cinchonas, but is, in fact, only a simple point of transit for the products of the valleys of the interior. It was towards these that he directed his course, passing through the snows of Illampo. The Rio Tipoani, the Pactola of Bolivia, takes its origin here. One of the most dangerous roads conceivable is that along the ravine bearing the above name, and leading to the village of Tipoani, a pestilential place, which nothing but the love of gain could render habitable. The cinchonas met with in all parts of this region are as much sought after as gold itself, but the larger trees are already beginning to disappear. In order to study the yet undetermined points, M. Weddell embarked on a raft constructed for the purpose, on which he descended in safety the rapids of the Rio Tipoani. He then visited the mountains of Rio Tumache. This expedition being terminated, he reascended the Rio Mapiri on his raft, and then took the route across the forests leading to Aten and Apolobamba, where he arrived exhausted with fatigue and overcome with the fever which he had caught in the regions of Tipoani. The country here assumes a more agreeable aspect. The forests have disappeared, or occupy only the horizon; the eye rests on pretty grassy slopes, interspersed with scattered shrubs, and frequently with charming groves. Here several species of cinchonas are met with, which scarcely exceed the shrubs in height, and of which the flowers embalm the air with their delicious perfume. The town of Apolobamba is the centre of one of the districts of Bolivia which was first explored. For a long time its forests have been stripped of cinchonas.

At the end of July, 1847, M. Weddell visited the province of Coraboya, one of the most interesting in Peru. It is divided by the Cordillera into two regions, one of which comprehends a long series of valleys, which furnish the greater part of the cinchonas now exported from the Peruvian Republic. It would be difficult to give an idea of all the vegetable treasuries buried in these solitudes. The thirst for gold originally peopled this district, but the forests have regained their empire, and the hatchet of the cascarillero now alone breaks the silence.

* Extracted from a work on this subject by M. Weddell.

We will here quote the words of the talented author :—The name of casearilleros, says M. Weddell, is given to the men who eut the einchonas in the woods ; an appellation equally applying to those who are speeially engaged in this commeree. The former, and of these alone I will speak here, are in general men who have been brought up to this laborious oeeupation from their infaney, and are aceustomed by a kind of instinet to guide themselves in the midst of the forest. Without any compass but that intelligenee peculiar to man in a state of nature, they guide themselves as unerringly in these labyrinths as if they were surrounded by an open horizon. But how often does it happen that those less experieneed in this art lose themselves and are never more heard of!

The only period which is not suited for the collection of einchona bark is the rainy season, which in duration eorresponds in some respects with our winter. If some persons contend that the period of the aseension of the sap is the best for stripping the trees, their precepts are eertainly not praetically adopted, for even during the rainy season the colleetion of the bark is only suspended on aecount of physical obstacles to its eontinuance.

The cutters are not generally engaged on their own account, but are mostly in the serviee of some merehant or small company. A eonfidential person is sent with them into the forests, who is ealled the major domo. It is his duty to receive and examine the barks which are brought to him by the different parties in the forest, and to superintend the distribution of the provisions.

The first thing done by those who engage in this kind of speculation in a region previously unexplored is to have it examined by experieneed casearilleros, who are ealled diestros or praeticos. The duty of these is to penetrate the forests in different directions, and to ascertain to what points they may be profitably explored. They are expected to state whether there are any einchonas, and in what quantity; also to point out the direetion in which the trees are to be found, and to report on the quality of specimens of the bark obtained.

This preliminary investigation is very important, and requires the possession of much sagacity, patience, and experienee in those who are engaged in it. It is upon their report that the chanees of success are ealculated. If it be favourable, a road is immediately commeneed up to the point which is to form the eentre of the operations; and from this time all those parts of the forest adjaeent to the road become provisionally the property of those who have formed it, and no other easearilleros can work there.

On the arrival of the major domo with his cutters in the neighbourhood of the part to be explored, he ehooses a favourable site for his eneampment, as near as possible to a spring or river. He constructs a hut or slight house to shelter the provisions and the produce of the cuttings ; and, if he anticipates having to remain for some time in the same loeality, he commences the eultivation of maize and a few vegetables. Experience, indeed, has shown that an abundant supply of provisions is one of the most important eonditions of success in this elass of undertaking. The cascarilleros, during this time, are distributed through the forest, one by one, or in small parties, eaeh earrying under a small eloak, and suspended at his back, provisions for several days, and the coverings whieh eonstitute his bed. In this way these poor beings have oecasion to put in practice all their courage and patienee in order that their work may prove fruitful. Obliged to have the hatehet or knife continually in his hand, to disembarrass himself of the numerous obstaeles whieh arrest his progress, the cascarillero is exposed, from the nature of the eircumstanees by whieh he is surrounded, to an infinity of aeeidents which too often endanger his life.

The cinchonas rarely constitute an entire forest, but form groups more or less compact, distributed in different parts of it. The Peruvians give these the name of manchas. In some eases, and most frequently, they grow separately. However this may be, it is in discovering them that the skill of the casearillero is principally exerted. If the position be favourable, the tops of the trees first attraet his notice ; a slight movement peculiar to the leaves of certain speeies, a particular colour of the foliage, the aspect produeed by a great mass of infloreseence, enable him to distinguish the einehonas from a great distance. Under other circumstances he eonfines his inspection to the trunks, of whieh the external layer of the bark, or enves, as it is ealled, presents remarkable eharacters. Very frequently the dry leaves which he finds on the ground are sufficient to indicate to him the vicinity of the objeet of his search ; and, if these indieations have been brought there by the wind, he knows in what direetion to look. An Indian, under these eireumstanees, is an interesting objeet for observation. Passing in and out through the narrow pathways of the forest, glaneing through the foliage, and appearing to sniff the earth, he seems to walk like an animal pursuing its prey, and darts forth when he thinks he has diseovered the object of his search, nor stops until he has arrived at the foot of the trunk which he had deseried from the distance. It is not always, however, that the exertions of the easearillero are productive of sueh favourable results. Too often he returns to the eamp empty-handed, and without provisions; and not unfrequently, when he has discovered on the side of a mountain indications of the tree, he finds himself separated from it by a torrent or ravine. Entire days may then pass before he ean attain the objeet which, during this period, he allows not to escape his sight.

In order to strip the tree of its bark it is felled with a hatehet, being cut a little above the root, and the bark previously removed from this part, so that nothing may be lost; and as at the base the bark is thickest, and therefore most profitable, it is customary to remove the earth from around the trunk, so that the barking may be more complete. The tree seldom falls immediately when eut through, being sustained either by elimbing plants or by the adjacent trees ; these are fresh obstaeles to be overcome by the easearillero. I remember having onee cut the trunk of a large einehona in the hope of bringing its flowers within reaeh, and, after having felled three adjaeent trees, had the mortification to find it yet standing, being held up by the interlacing creepers.

When at length the tree is down, and the useless braneh es have been eut off, the peridermis is removed by striking it, either with a little wooden mallet, or even with the back of the hatchet; and the inner bark, being thus exposed, is often further eleaned by means of a brush. The bark is then divided by uniform ineisions eireumscribing the pieees which are to be removed, and these are separated from the trunk with a eommon knife or some other instrument, the point of which is carried as elose as possible to the surfaee of the wood on introducing it into the incisions previously made; and, if the position of the trunk prevents the operator from removing the whole of the bark by the first operation, it is subsequently divided, so as to admit of its being turned. The dimensions and regularity of pieees neeessarily depend more or less on eireumstanees. In general, however, for the eonvenience of transport and facility of preparation, they endeavour to make them from fifteen to eighteen inehes long and four or five inches wide. The bark of the braneh es is separated in the same way as that of the trunk, exeepting that it is not deprived of its exterior coating or peridermis.*

* Formerly, with very few exceptions, the bark deprived of its peridermis was not received in eommerce ; not that any virtue was supposed to exist in that part, but it furnished distinctive charaeters, by which it was easily known, and rendered difficult of substitution. The necessity which was thus imposed upon the cascarilleros of preserving this, in many cases, frail part demanded on their part the greatest care. Thus in many places it was the custom to fell the tree two or three days before barking it, so that, desiecation having commeneed, the different layers of bark might adhere together. I think that the removal of the peridermis from the surface of the thiek barks at the time of cutting is not quite general. Some of the cinchonas of New Granada which I have recently seen retained the outer coating. However this may be, we pereeive the necessity of studying the bark under both aspeets. I am persuaded that many museum specimens, eolleeted at a period when it was eustomary to preserve the peridermis, would no longer be thought of doubtful utility, if considered in this point of view. The proeess formerly employed for separating the young barks from the weod also differs much from that whieh is now practised ; henee there is a eertain difference in the formation of the eylinders prepared by the two methods. I have already deseribed the way in whieh it is now done, and it is easy to understand that by this method the dimensions of the separated pieees may depend on the patience or skill of the easearillero, or on the eireumference of the branch or trunk from which they are taken. Formerly, on the other hand, each piece was cut by one operation, the easearillero holding his knife by the two extremities, and drawing it rapidly towards him. The flat pieces obtained in this way necessarily varied in width, according to the size of the trunk from which they were taken, and the quills when dried were frequently no larger than a pen. The pieces also had sharp edges, and they were thieker at the eentre. The defect of this method was the immense loss whieh resulted, for nearly as mueh bark was left on as that which they removed, the former being considered useless on aecount of its being deprived of the peridermis. But this loss was as nothing when compared with that whieh I have next to notice. I allude to the almost entire rejeetion for some time of the bark of thiek trunks. The loss resulting from this cause was immense. Many of those experienced in this subject having affirmed that with age the juices disappear by degrees from the bark, and that those barks only are efficacious which are taken from braneh es of moderate size, four times as many trees were sacrificed as would have been the ease under other circumstances. It has been said, it is true, that the cascarilleros climbed the trees to cut off the branches, taking eare to leave the terminal braneh ; but those whom I have known have always candidly confessed that they found the most simple method to be that of cutting the trees down, and this, I believe, has been the uniform practice. Thousands of quintals of cinchona bark have been thus left to perish in the forests ; and it has only been sinee the inutility of the praetice has been proved by chemical analysis that it has been diseontinued. It is not to be eonsidered, however, that the bark of old trees contains as much of the active prineiple as those which have only arrived at maturity. There are limits between whieh all are good ; indeed, none ought to be rejected.

The details in the proeess of drying also vary slightly in the two eases ; the thinnest pieces of bark from the branches or small trunks, intended to make the quilled cinchona, are simply exposed to the sun's rays, and of themselves take the desired form, whieh is that of a hollow cylinder ; but the bark taken from large trunks, which is to eonstitute the flat einchona, or, as it is called, tabla or planeha, must neeessarily undergo a eertain degree of pressure during the proeess of desiceation, without which it would become misshapen, or take a cylindrical form as in the preeeding ease. To effect this, after first exposing the pieces of bark to the sun, they are placed one on the other in crossed squares, in a similar manner to that praetised in timber-yards in the arrangement of the planks of wood, and on the top of this pile a heavy weight is plaeed. This process is repeated for several days until the bark is completely dried.

The above process is that most commonly adopted in preparing the cinchonas; but it will be easily comprehended that this must vary in some degree according to the locality, or the nature of the tree operated upon. In many places the bark is not pressed at all, or but imperfectly so, and it is then generally out of form or slightly curled. The peridermis is often but partially removed or simply scraped. Finally, whether it be accidental, or whether it be done with the view of augmenting the weight, there frequently remains a certain quantity of moisture in the bark, which greatly deteriorates it. It thus appears that cinchonas which would have presented the same characters if similarly prepared may, according to the circumstances, vary very greatly. In any of these cases the labour of the cascarillero is by no means ended even when he has finished the preparation of the bark; he has yet to carry his spoil to the camp, and, with a heavy load on his shoulders, to retrace his steps along those parts which, while unburdened, he traversed with difficulty. The labour involved in this part of the operations can hardly be conceived. I have seen more than one district where the bark has to be thus carried for fifteen or twenty days' journey to get it out of the wood from which it was obtained; and, considering the amount of remuneration received, I could hardly imagine men so unfortunate as to engage in work so laborious and ill paid.*

Something yet remains to be said with reference to the packing of the bark. It is the major domo who performs this duty. As the cutters bring him the bark the produce of their labour, he submits it to a slight examination, and rejects that which is bad. It is then, if necessary, exposed to a fresh process of desiccation, and formed into bundles of nearly equal weight, which are sewn up in coarse canvas kept for that purpose. In this condition the bundles are conveyed on the backs of men, donkeys, or mules, to the depôts in the towns, where they generally receive an exterior envelope, consisting of a fresh hide, which as it dries makes a hard and compact package. In this form the packages are known by the name of serons, and it is thus that they arrive in Europe. The usual weight of a seron is from seventy to eighty kilogrammes (kilogramme 2 lbs. 3 ozs. avoirdupoise); but the weight is sometimes much less than this. From these details it will be seen how erroneous the notions of some persons still are with reference to the collection of cinchona bark; many having thought that it continues under special surveillance as it was formerly represented to be; and others, that the cinchona-trees are cultivated in enclosed parks, and treated as the cork-trees of our country. It must be acknowledged that the mode of collecting this valuable product appears to be always under the control of the half-savages by whom it is performed; and, if some efficient means be not discovered of counteracting the ruinous and wasteful method adopted, our descendants will, inevitably, have to regret the entire, or at least partial, extinction of the different varieties of cinchona.

The opinion of those who calculate upon the forests being restocked from seeds, and from suckers thrown out from the stumps of the fallen trees, is more nearly in accordance with truth; but, as will be seen, even this source of renewed supply can only be depended upon to a certain extent. Too often the suckers, recklessly cut down, perish with the trunks to which they were attached; and the young trees, which very slowly attain to a certain degree of development, fall in their turn beneath the hatchet, never again to appear. The same may also be said of the seeds. A supervision and control exercised over the cutters, by means of inspectors, would, to a certain extent, check this vandalism, but, unfortunately, could not practically be carried into operation. The inspection of the woods in our country is a very different thing from inspecting a forest in the New World, especially if this forest cover 20,000 square miles.

In fact, it appears to me that there are but two methods which could be adopted for preventing the rapid destruction of the cinchona-trees. One is to limit the exportation to a quantity proportionate to the sustainable produce of the forest; the other, that of making the trees objects of regular cultivation. To limit the exportation would certainly be the most efficacious method; but is it not to be feared that the disproportion between the consumption and production is already too great to admit of the balance being restored? and, moreover, are not our wants too pressing to give way to considerations affecting only the future?* There remains, then, cultivation, and this must be resorted to. If there be a tree which is worthy of being acclimated in a French colony, it is, certainly, the cinchona, and posterity will be grateful to those who may succeed in putting this plan into execution.

In a subsequent article we propose noticing the particular notions of M. Weddell on the classification of the cinchonas; to which will be added the description of several new species, for which science is indebted to the learned researches of this naturalist.—*Journal de Pharmacie et de Chemie.*

* In general, before the product reaches the coast it passes through at least three or four hands, and on each occasion its price is augmented; moreover, as carriage is very expensive, it follows that the price charged in Europe will afford no idea of its cost on the borders of the forest. At Pelechuco, for instance, one kilogramme (2 lbs. 3 oz. avoirdupoise) is only worth a franc and a half (fifteen pence), and for this twenty francs are now paid in Paris.

* In support of this view of the subject we may cite the case of the Company of La Paz, to whom the Bolivian Government conceded the monopoly of the commerce of the cinchonas of Bolivia, with the power of annually exporting 4,000 quintals, or 40,000 Spanish pounds. The restriction imposed in this case was never observed, and complaints have been made that the quantity allowed to be exported has been greatly exceeded. What would it be, then, if the restrictions were entirely removed, as they are in most other parts, and especially in Peru, where the exportation, during some years, has attained to an extent which is almost incredible? In New Granada, at the time when the commerce of cinchona bark was carried to the greatest extent, that is to say, at the commencement of this century, the quantity exported from Carthagena alone amounted in one year, 1806, to the enormous extent of 1,200,000 pounds. In the present day, on the contrary, scarcely any is exported.

ON MEDICINAL WINES.

By BUTLER LANE, M.D.

[*Concluded from page* 275.]

I now have to speak of those medicinal wines individually in the use of which I have most experience, and to point out that which I have found the best method of preparation.

Vinum Sennæ.—This may be made from a cold or hot infusion of the senna-leaves; but I much prefer the former. The senna should be digested in two separate quantities of water, twenty-four hours with each, the leaves being well strained and pressed. The infusion may be made in the proportion of that of the Pharmacopœia, or double the strength; and there must even be less water than accords with either calculation, so as to admit the addition of the sugar without too much increase of bulk. Should too much fluid be obtained, the proceed of the second digestion may be evaporated by a gentle heat, so as to reduce the quantity within the necessary limit. If a sweet preparation be desired, the gallon must contain at least four pounds of sugar. I am much inclined to prefer the lower temperature for the fermentation of senna wine; it renders it somewhat more tedious, but much more perfect and permanent. The atmospheric air must be gradually more and more excluded as the fermentation subsides.

I can speak highly of senna wine as an efficacious and agreeable aperient; in a sufficient dose it acts efficiently by itself, and almost always without occasioning the slightest nausea or griping, even though uncombined with any carminative. Saline matter is not very soluble in the wine; but I usually find that the addition of neutral sulphate of potash will materially augment the cathartic action. The senna wine is exceedingly palatable, and no child will object to the sweet preparation. It keeps admirably when well prepared; I have had some in use which had been made six months, and had undergone no deterioration.

Vinum Rhei.—This is best prepared by repeated maceration of the drug in boiling water, and should be of the strength of one in sixteen, which is four times stronger than that of the Pharmacopœial infusion. The gallon should contain three pounds of sugar or more for a sweet preparation. It is rather difficult to obtain the wine clear, but it keeps well, and is a most efficient and useful preparation. There is a great amount of deposit during the fermenting process. I obtained two and a half ounces of residuum from one pound of East India rhubarb, but I have found this fæcal matter almost inert. The wine answers all the purposes of rhubarb in a solid form, and is far more convenient and less nauseous.

Vinum Aloes.—I make it of the strength of one to ten, with the addition of sugar, myrrh, liquorice, and saffron, in the following proportions:—Barbadoes aloes, twelve ounces; liquorice, twelve ounces; myrrh (bruised), eight ounces; saffron, two ounces. These materials are to be digested in seven and a half pints of water, with the aid of a gentle heat; the liquid is then to be strained off through fine canvas, and, a pound and a half of sugar being added, it is ready for the fermenting process. This is an elegant preparation, not so unpleasant to the taste as might be expected, and is very effectual as a stomachic and aperient. It acts mildly, and does not gripe, probably owing to a large proportion of the resinous matter being got rid of. The wine of aloes will be found a desirable substitute for the compound decoction, to the action of which it closely assimilates.

Vinum Ipecacuanhæ.—This must be made by treating the recently-bruised root with hot water, and straining off the infusion so as to get rid of the ligneous matter. A full proportion of sugar must be used. When the fermentation has gone to a sufficient extent, a small quantity of spirit of wine should be added, in order to arrest further action, which is apt to assume an acetous character.

Vinum Gentianæ.—The gentian wine is an exceedingly genial and efficient stomachic, and is obtained with much facility. It may be prepared of the same strength and with the same adjuncts as the Pharmacopœial tincture, and requires three pounds of sugar in the gallon for its fermentation.

Vinum Valerianæ, Vinum Calumbæ, Vinum Serpentariæ.—I have prepared these wines of the same strength as the tinctures; they very obviously possess the properties of the drugs, and effectually represent the respective constituents.

Vinum Cinchonæ.—This is an agreeable preparation, and appears to retain within it all the virtues of the bark. It should be made of the same strength as the simple tinctures of the Pharmacopœia, with at least three pounds of sugar in the gallon. After sufficiently long infusion and coction, the woody matter will be found to remain perfectly tasteless, and the sediment thrown down after fermentation is so likewise, presenting a resinous character, and when treated with acid affording no trace of crystalline matter. The wine or bark is a very valuable preparation. It, however, takes a long

time to mature perfectly, and improves materially by keeping.

Vinum Opii.—The wine of opium is easily prepared. It may be made the same strength as the tincture, and I think that sugar should be used in more than the average proportion, say four pounds in the gallon. The opium is to be repeatedly macerated in hot water for some days, and the fluid extract strained through fine canvas; the sugar is then to be added, and the liquid submitted to fermentation in the usual manner. I feel certain that the pharmaceutist may with confidence recommend the wine of opium to the notice of the prescriber. In common with others who have given it a trial, I certainly find it in the highest degree efficacious, and am often able to substitute it for morphia, when the effects of the tincture of opium are decidedly objectionable. I have carefully examined that portion of the opium which remained unstrained in the first place, but could detect no traces of morphia, though the presence of narcotine was apparent. When dried and powdered I have also administered this matter to the extent of scruple doses, but it evidently exerted no anodyne influence, though in some instances there was a stimulating effect, indicated by increased warmth of skin and fulness of pulse. The residuum which subsides after the fluid has undergone fermentation has a resinous character; its microscopic and chemical examination does not discover the presence of morphia, though it demonstrates that of narcotine.

Vinum Conii.—This may be prepared the same strength as the tincture. I have used it in affections of the lungs, &c., and have found it equivalent in its action to the extract; and some which had even become acetous did not appear at all to have lost its medicinal power.

Vinum Digitalis.—I have made this of the same strength as the tincture, and find it a most efficacious preparation, evidently retaining the active principle of the drug in a perfect state of solution.

Vinum Hyoscyami.—Though exceedingly desirous to obtain a thoroughly good preparation of henbane, I cannot say that I have succeeded to my satisfaction. Whether the peculiar chemical composition of the plant interferes with the fermenting process I am unable to ascertain. In some trials I separated as much as possible of the mucilago-albuminous matter which had become coagulated, both before and during fermentation, but still the result did not answer my expectation.

Vinum Catechu, Vinum Kino.—These may be made the strength of their respective Pharmacopœial tinctures, but without any aromatic adjuncts. They are very pure solutions of tannic acid, and are certainly preferable in many respects to the infusions or tinctures.

I may now repeat, that from a careful examination of the various preparations which I have made, and the review of notes which I have taken respecting them, I am convinced that it is always preferable to effect the fermenting process at the lower temperature which I have mentioned, between 55° and 65°. I also feel confident that it is desirable that the atmospheric air should be excluded as soon as possible, its free admission, even at an early period of the fermenting process, tending to induce acetous action; thus, when the liquor is once placed in tubs or jars, it should on no account be disturbed, and the vessels should be closed as soon as possible, leaving a mere venthole for the escape of gas. I would suggest whether the introduction of sulphuret, bitartrate, chlorate, or carbonate of potash, at a proper stage of the fermentation, might not produce an effect analogous to the formation of tartar in grape wine, and so tend to the perfection of the fermenting process.

It can be readily calculated that the medicinal wines possess much advantage in point of economy over the tinctures; half a gallon of spirit of wine is a material item of expense in the preparation of a gallon of tincture, in comparison with a few pounds of sugar; and though some trouble and inconvenience (especially at first) may be experienced in the manufacture of the medicinal wines, yet they will be much more available than infusions and decoctions, being equable in strength, and not liable to spoil and waste.

In addition to my own testimony in favour of the efficacy of the fermented preparations, I may mention that Mr. Allan, and Dr. Shelley, of Epsom, are now constantly in the habit of using them, and speak of them in the highest terms. Dr. Golding Bird has also done me the favour to try the wines of opium, aloes, and senna at Guy's Hospital. He acknowledges them to be excellent and efficient preparations, and that, though made many months, they were in perfect preservation. He questions, however, whether they may not be open to the same objection as the old cerevesiæ, namely, being liable to turn sour; but if the simple chemical principle be properly applied, and thorough fermentation effected, I see no reason to expect it, and can fairly appeal to the results of my experience.

I shall now leave my suggestions in the hands of the pharmaceutical profession. No doubt the method of preparing the medicinal wines which I have described is susceptible of much improvement, and I hope that I may be successful in inducing others to turn their attention to the subject. I feel assured that the pharmaceutist who makes it his study will find his advantage therein; and that, when a sufficient degree of uniformity and perfection is obtained, the medicinal wines will not fail to assume the character of popular medicines, as well as to recommend themselves strongly to the notice of the prescribing physician.

ON THE AVA-ROOT OF THE SANDWICH ISLANDS.

By W. HAMILTON, M.B.

[From "The Pharmaceutical Journal."]

It is so many years since I read the interesting narratives of Captain Cook's enterprising voyages that I only retained a faint and imperfect recollection of the ava of the Sandwich Islands, as a plant whose root produced, by a process described, I believe, by Cook, an intoxicating liquor, the inebriating properties of which excited the natives almost to frenzy, and were, I believe, among the proximate causes of the melancholy catastrophe which prematurely closed the brilliant career of that great navigator's valuable discoveries. Not dreaming, however, of its possessing any redeeming qualities to compensate its injurious effects upon society, I did not deem it worth the trouble of investigation, nor, although from our intimate acquaintance with those islands and their productions, since the melancholy catastrophe to which I have alluded, the ava plant must have been long since familiar to every botonist, am I acquainted with the slightest particulars respecting its botanical history or classification.

In the hope of obtaining, through some of the readers of your journal, the information of which I am so lamentably deficient, I venture to intrude upon their notice a brief account of its medicinal properties, taken from the extract given by Captain Beechey in the 120th and following pages of the second volume (octavo edition) of his "Narrative of the Voyage of the Blossom," from the journal of Mr. Collie, the scientific surgeon of that ship.

Mr. Collie acquaints us that he had an opportunity of witnessing its effects upon

"A gentleman, a foreigner, who had undergone a course of it to remove a cutaneous affection, said to have been similar to St. Anthony's fire. It had affected at different times almost every part of the body, going from one place to another, but had been particularly obstinate in one leg. He took two doses a day, of half a pint each, one before breakfast and one before dinner, by which his appetite was sharpened, and by the time he had finished his meal a most pleasing state of half-intoxication came on, so that he was just able to go to his couch, where he enjoyed a sound and refreshing sleep.

"About the second or third week the eyes became suffused with blood, and the cuticle around them began to scale, when the whole surface of the body assumed the appearance above described. The first dose is continued for a week or so, according to the disease, and then gradually left off. The skin clears at the same time, and the whole system is highly benefited."

Such is Mr. Collie's account of the medicinal effects of this root in a case, it must be admitted, of a somewhat intractable erysipelatous eruption, in which he had an opportunity of personally watching the progress of cure. But he relates another case, of a still more severe description, in his own practice, in which its curative properties were still more decidedly manifested. His statement is as follows:—

"I recommended the ava, and had an opportunity of seeing the first effects upon a man affected with chronic superficial ulceration, affecting the greater part of the toes and the anterior part of the soles of the feet. The legs and feet were œdematous and swelled; the pain was very distressing, preventing any sound repose, and not permitting him even to lie down, or bring them up so as to be near a line horizontal with the body. The ulcers were covered with a tough, viscid, dark-coloured discharge, that adhered to the surface, and entirely concealed it. His frame was emaciated, pulse quick and irritable, appetite gone, tongue dry and reddish. He had taken mercurial preparations at two previous periods, as he said, with considerable benefit; but, for want of the medicines, it was stopped when the sores were nearly healed. He had been, and I believe still was, addicted to drinking spirituous liquors. The ava was given three times a day, with the same immediate effects as before mentioned; and, at the end of ten days, the ulcers were clean and healing. From the commencement of the course he had been able to lie down, allowing his feet to hang over the bedside; he had slept soundly, and his appetite was good. Could he have procured a suitable dressing for the ulcers, with appropriate support for the œdematous extremities, I have no hesitation in saying that the plan would have succeeded. Even with all these disadvantages, I am inclined to believe that a cure will be effected if he abstain from liquor."

Both these are extreme cases, in which the powers of the ava were put to the severest test; and, although the recovery in the latter was not as complete as could have been wished, still the results were satisfactory in the highest degree, and the counteracting influences fully account for the partial failure.

"A course of this root," as Mr. Collie observes, "is most beneficial in renovating constitutions which have been worn out by hard living, long residence in warm climates, without, however, affections of the liver, and by protracted chronic diseases, more especially if the disorder be such as, by the humoral pathologists, would be attributed to an attenuated or acrid state of the blood."

The ava is, I believe, found in most of the intratropical islands of the Pacific, although the Sandwich Islands are, perhaps, its most extreme northern limit. Those, however, who are familiar with the narratives of voyagers in those seas can correct me if I am in error. From Mr. Collie's account it would appear to be a suitable remedy for many of those cutaneous and glandular affections which are common in tropical climates, and frequently baffle the utmost exertions of medical skill, and only give way on a removal to colder regions; such, for example, as frambæsia, or the yaws, a complaint closely resembling the sibbens of Scotland, and often difficult of cure. Elephantiasis, also, a complaint so frequent in the island of Barbados, as to have obtained for the enlargement of one or both of the lower extremities, which has given it its nosological appellation, the vernacular name of the Barbados leg, and which is generally re-

garded in the West Indies as nearly incurable, is another in which a course of the ava-root might, perhaps, be tried with advantage. But there is yet another complaint still more deplorable, and even more intractable, than either of these, to which it would appear to be singularly adapted; and I am only surprised that no attempt has been hitherto made to naturalize it in islands which from the similarity of their climate, seasons, and geographical position, appear singularly suited to its cultivation. The disorder to which I allude is leprosy, one of the most deplorable under which humanity can labour, and from which no class of society is favoured with exemption.

To these may be added the joint evil, a malady chiefly confined to the blacks, if not peculiar to them, and a vast variety of herpetic and other cutaneous eruptions, which are frequently most obstinate in resisting every effort made for their removal.

The introduction of this plant into our islands might ultimately lead to its adoption in our British Pharmacopœia, and thus augment the number of remedies placed at the disposal of art for the relief of the sufferings of humanity. It would thus add to the number of imports from those islands, and, by diversifying the products of agriculture, benefit at once the planter, the merchant, and the importer.

14, Octagon, Plymouth, Sept. 27, 1849.

ON THE COMMERCIAL VARIETIES OF GINGER.

By JONATHAN PEREIRA, M.D., F.R.S.

[From "The Pharmaceutical Journal."]

In the preparation of the third edition of my "Elements of Materia Medica" I have had my especial attention drawn to the different commercial varieties or sorts of the several articles of the materia medica, amongst many others to those of ginger. Perhaps the following notice of the varieties of ginger now met with in the English market may not be uninteresting to some of the readers of "The Pharmaceutical Journal."

I have met with ginger in three different states in the English market, namely, in the fresh state, forming what was termed green ginger; secondly, in the state called preserved ginger; and, lastly, dried ginger, the usual form in which it is sold by grocers and druggists.

1. GREEN GINGER.

Small parcels of this have been brought over from Jamaica. The samples which I have met with were soft, and had the character of rhizomes which had been recently taken out of the ground. I am informed that in a commercial point of view they were worthless, most of them having perished on the journey. Recently none has been imported.

2. PRESERVED GINGER.

As this is chiefly used as a condiment and dessert, it will be unnecessary to describe it. Two sorts are now in commerce.

1. *Jamaica Preserved Ginger.*—This is the finest imported. It comes over in jars (seldom in barrels) of various sizes. Its value is 3s. per lb. duty paid.

2. *Barbados Preserved Ginger.*—This is not so fine as the preceding, and is seldom imported, say perhaps only once in two years. It comes packed in jars. Its value is from 2s. to 2s. 3d. per lb.

3. *China Preserved Ginger* is large but stringy. It is generally imported in jars of about 6 lbs. each, seldom in barrels. Its value is 1s. 6d. per lb.

4. *China Dry Preserved Ginger* has been sliced before preserving. When preserved it is packed and imported in boxes. It is not often brought into the London market.

3. DRIED GINGER.

General Description.—The dried rhizome, called in commerce ginger-root (radix zingiberis), occurs in flattish, jointed or branched, lobed, palmate pieces, called hands or races. The largest rarely exceed four inches in length. The larger, bolder, and plumper the races, the more they are esteemed in commerce.

Some of the commercial sorts have not been deprived of their epidermis, which is dried on them, and give the races a shrivelled character. Other sorts have been carefully scraped and peeled while in the green state. The first are said to be coated, or unscraped; the second uncoated, or decorticated, or scraped. Considered with respect to the presence or absence of the coat, the commercial sorts of ginger may be thus arranged:—

Uncoated or Scraped.	*Coated or Unscraped.*
Jamaica Ginger.	Barbados Ginger.
New Malabar "	Old Malabar "
New Bengal "	Old Bengal "
	African "

Although the colour of ginger is an important consideration in determining the commercial value of this root, it is difficult to describe in words the different colours which characterize the various commercial sorts of ginger. The terms white and black ginger formerly in use merely mean that some sorts are paler or whiter, others darker or blacker; but absolutely white or black ginger is of course unknown. But the different sorts of ginger pass almost insensibly from the one into the other, so that it is impossible to refer them absolutely to the pale or dark sorts. Mr. Faber tells me that, were he to classify them according to their external colour, it would be thus:—

Grey or Dark.	*Intermediate.*	*Bright Yellow or Pale.*
Old Bengal.	Barbados.	Jamaica.
New Bengal.	Old Malabar.	New Malabar.
	African.	

The internal colour of ginger and its softness or hardness, as observed by cutting it, is another important character. The brighter and paler the colour, and the softer the texture, the more highly is ginger valued. Ginger which is dark and hard, or flinty to the cut, is of inferior value. A transverse section of the larger and more perfect pieces shows an outer, horny, resinous-looking zone, surrounding a farinaceous centre, which has a speckled appearance from the cut extremities of the fibres and cuts.

Varieties.—Several varieties of ginger are met with in English commerce. These we may conveniently arrange according to the countries producing them, in three classes: 1st, West Indian; 2dly, East Indian; 3dly, African.

1. *West Indian Gingers.*

This division of gingers includes two sorts, Jamaica and Barbados, which may be taken as the types of all other sorts of ginger. Unlike the East Indian kinds, they are rarely wormy.

1. Jamaica Ginger (radix zingiberis Jamaicensis).—The sort of Jamaica ginger now found in commerce was formerly called white ginger, to distinguish it from an unscraped sort, which was termed black ginger. The latter does not now occur in English commerce.

Jamaica ginger is imported in barrels holding one cwt. each. It is a scraped or uncoated pale sort. When of fine quality it consists of large, branched, plump, and fleshy soft races, whose texture is fibrous and mealy, and which externally are yellowish white or pale buff, and internally when cut present a bright but pale tint. Inferior samples consist of small shrivelled races, which have an ash-grey tint externally, present a brownish colour internally when cut, and have a hard or flinty texture. Good Jamaica ginger yields a beautiful bright straw-yellow, somewhat buffy, powder.

2. Barbados Ginger (radix zingiberis Barbadensis).—This is imported in bags of about sixty or seventy pounds. It is an unscraped, or coated, somewhat pale sort.

Its races are shorter, less branched, flatter, and darker coloured than Jamaica ginger, and are covered with a corrugated epidermis.

[*To be continued.*]

ON CINCHONA CALISAYA.

By M. WEDDELL.

In the "Annales des Sciences Naturelles," t. x., Juillet 1848, M. Weddell takes a review of the genera Cinchona and Remijia, D.C., and of Endlicher's sub-genus Cascarilla. He mentions the specific characters and localities of several new species which he has discovered in South America. Of these the most important is the Cinchona Calisaya, the plant which yields the yellow or Calisaya bark; and we, therefore, subjoin his account of it:—

C. Calisaya. C. foliis oblongo vel lanceolato-obovatis, obtusis, glabratis, nitidis, subtus in axillis venarum scrobitulatis; filamentis dimidio antherarum brevioribus; stigmatibus subexsertis; capsula ovata, flores vix æquante, dupla sua latitudine fere breviore; seminum ala elliptica, magine cilialo-denticulata, denticulis approximatis obtusiusculis.—*Hab.* in Bolivia.

TABLE OF COMMERCIAL CINCHONA BARKS,

WITH THE BOTANICAL SPECIES FROM WHICH THEY ARE BELIEVED TO BE OBTAINED.

I. GREY CINCHONA BARKS.

§ I. Loxa Cinchona Barks. (Crown Bark Angl.—China-Loxa, Kron China Germ.)	
Loxa Cinchona bark, grey compact	Cinchona Condaminea H. et B.
Loxa Cinchona bark, brown compact. (Dunkele Ten China Germ. — China pseudo-Loxa Bergen)	C. scrobiculata H. et B.
Loxa Cinchona bark, red chesnut.—Light Calisaya.	
Loxa Cinchona bark, red fibrous of the King of Spain (Quina estoposa Pav. in collect. Lamb. Mus. Brit.)	
Loxa Cinchona bark, yellow fibrous	C. macrocalyx Pav.
§ II. Lima or Huanuco Cinchona Barks. (Silver Bark, Grey Bark Angl. — China Huanuco, Graue China Germ.)	
Lima Cinchona bark, grey brown (Cascarilla provinciana Peruv.).	C. micrantha Ruiz et Pav. or C. lanceolata Ruiz et Pav.
Lima Cinchona bark, grey ordinary	
Lima Cinchona bark, white.	? C. purpurea Ruiz et Pav.
Lima Cinchona bark, very rugous, resembling the Calisaya bark.—Cascarilla negrilla Peruv. (? Cascarilla lagartijada Laubert.)	C. glandulifera Ruiz et Pav.
Cinchona bark, red of Jaen or of Loxa	?

II. RED CINCHONA BARKS.

(Red bark Angl. Rothe China Germ.)

Red Cinchona bark, becoming white in the air	?
Red Cinchona bark of Lima	C. nitida Ruiz et Pav.
Red Cinchona bark true, non-verrucous (Cascarilla roja verdadera, Laubert).	
Red Cinchona bark, officinal	
Red Cinchona bark true, verrucous	
Orange-red Cinchona bark, verrucous	?
Pale red Cinchona bark with a white surface	
Brown Carthagena bark	
Red Carthagena bark	

III. YELLOW CINCHONA BARKS.

Yellow Cinchona bark of the King of Spain (Cascarilla amarilla del rey. Laubert).	C. Calisaya Wedd.
Calisaya Cinchona bark, or Royal Yellow bark (Königs China Germ. — Yellow bark Angl. — China regia Bergen)	

Orange-yellow Cinchona bark—Cinnamon Cinchona bark (quinquina — cannelle), light Calisaya (cascarilla claro-amarilla Laubert)...	C. micrantha Ruiz et Pav.
Pitaya Cinchona bark (Quinquina de la Colombie ou d'Antioquia Guib. Hist. Nat. des Drog.—Cascarilla parecida à la Calisaya Laubert).....	C. Condaminea Humb. et Bonp.
Woody Carthagena bark (Quinquina de Colombie ligneux).....	
Orange Cinchona bark of Mutis (Spongy Carthagena bark; New Spurious Yellow bark Pereira).	C. lancifolia Mutis.
Huamalies Cinchona Bark. (Rusty Bark Angl. — China Huamalies, Braune China, Germ.)	
Huamalies Cinchona bark, dull grey	C. hirsuta Ruiz et Pav.
Huamalies Cinchona bark, thin reddish.....	? C. purpurea Ruiz et Pav.
Huamalies Cinchona bark, white	?
Huamalies Cinchona bark, ferruginous	C. micrantha Ruiz et Pav.
Yellow Cinchona bark of Cuenca..... ...	C. ovalifolia H. et B.
IV. WHITE CINCHONA BARKS.	
Ash-coloured Loxa Cinchona bark (Ash bark Angl.—Blasse Ten-China Germ.—China Jaen Bergen).	C. ovata Ruiz et Pav.
Grey Cinchona bark, pale ditto	
White Loxa Cinchona bark.	
White fibrous Jaen Cinchona bark	
Cuzco Cinchona bark	C. pubescens Vahl., or C. cordifolia Mutis.
Arica Cinchona bark	
Pale yellow Carthagena Cinchona bark.—(Hard Carthagena bark Angl. — Quina amarilla Mutis — China flava dura Bergen.)	Ibid.
Orange-yellow Carthagena Cinchona bark (Quinquina de Maracaïbo. — China flava fibrosa Bergen.)	
Pitayon Cinchona bark, or false Pitaya Cinchona bark	?

The following, according to M. Guibourt, are the most active barks:—

1. Calisaya Cinchona bark.
2. Yellow-orange "
3. Pitaya "
4. Verrucous true red "
5. Non-verrucous true red Cinchona bark.
6. Red Lima "
7. Grey Lima "
8. Verrucous white Huamilies "

(Weddell, *Hist. Naturelle des Quinquinas*, fol. 1849.)

Royal College of Surgeons.—The following gentlemen, having undergone the necessary examinations for the diploma, were admitted members of the college, at the meeting of the Court of Examiners on the 9th instant:—Messrs. Alexander Williams, Army; Ralph Holt Kaye, Ratcliff-bridge, Lancashire; John Robinson, Medhurst, Sussex; James Howell, St. Clere, Carmarthenshire; Henry Nuttall, Syston, Leicestershire; Thomas John Warburton, Betley, Staffordshire; George Peat Dunn, Ledbury, Herefordshire; Walter Hook Bolton, Carrickmines, county Dublin; George Fowler Bodington, South Colfield, Warwickshire; and William Bratt, Stratford-on-Avon. At the same meeting of the court Mr. William Newman Brake passed his examination for naval surgeon. This gentleman had previously been admitted a member of the college, his diploma bearing date May 16, 1844.

THE CHEMICAL TIMES.

SATURDAY, NOVEMBER 17, 1849.

THE GRAVEYARD LEGISLATION OF THE BOARD OF HEALTH.

"What are you called watermen for?" asks the *quidnunc* of one of the brass-badged gentlemen attending the London cabstands. "Because," answers the "waterman," with singular perspicuity and relevancy, "because *we opens the hackney-coach doors!*" With equal perspicuity and equal relevancy might the incongruous and anomalous tribunal holding its sittings at Gwydyr-house, and which boasts of Lord Ashley, Mr. Chadwick, and Dr. Southwood Smith for its *coryphæi*, reply to any cross-examination as to *why* it was called the Board of Health by the statement that it was because its enactments were decidedly inconducive to anything in the shape of health.

The recent directions of the board respecting the metropolitan burial-grounds are dictated in a spirit of so much wrongheadedness, of so much narrowmindedness, and, in fact, of such utter ignorance and disregard of the requirements of the subject, and of the occasion, that we feel ourselves compelled to visit them with our strongest reprehension, convinced as we are that their being carried out would not only fail in remedying the evil complained of, but would substitute for one nuisance, already, Heaven knows, dangerous and disgusting enough, one positively of a more aggravated character.

Not content with prescribing a deadly narcotic combined with alcohol (laudanum and brandy) for the general use of families—in fact, as the young and old man's best companion—not content with prohibiting the fruits and vegetables which a wise and beneficent Providence has provided for our nourishment—not content with tampering with our drainage, and establishing a system of Paul Pry espionage into our dwellings, the sapient Board of Health have capped their sanitary achievements by an equally sapient order to desecrate our graveyards, to destroy the wholesome vegetation with which their surfaces were covered, and to poison the surrounding neighbourhoods, by the deposing of a layer of quicklime not less than three inches in depth on every portion of their area, excepting the pathways. This direction is accompanied by sundry other peddling provisos relative to the disposal of coffins, the minimum depth at which they may be buried, and the distance at which they are to be placed from each other.

God knows that we are no advocates for the abominations attendant on, and almost inseparable from, intramural interments. The sooner the Golgothas are shut up, vested interests, clerical rights, &c., notwithstanding, the better it will be for the health and the morality of the metropolis. But we take exception against the Board of Health for the incompetent and the truckling spirit in which its edicts are conceived. With a paltry wish to preserve a *juste-milieu* between vested interests on the one hand and the sanitary rights of the people on the other, it prescribes inefficient and unwholesome half measures for the subjugation of a great evil, without the moral courage—it has, or ought to have, the legal power—to abolish and to destroy it altogether. The quicklime slush with which some of the suburban churchyards are covered has become a decided nuisance; the directions regarding the coffins, and the bones, and the bed of lime for each coffin are, emphatically, "*bosh;*" and, till we see the Board of Health assume the initiative in a really suggestive and efficient manner—till we see the authority it rightly possesses wielded in an abler, a more sagacious, and a more courageous spirit—so long will it have our opposition and incur our animadversion.

HEALTH OF LONDON DURING THE WEEK.

[From the Registrar-General's Return.]

In the week ending last Saturday the deaths registered in the metropolitan districts were 893, a number which shows an excess of 56 on the return of the previous week, but a reduction of 269 on the corrected average of five autumns. If the present return be compared with that made in the same week of each of the years 1840-8, it will be found that, with but one exception (in 1841, when the deaths were 841), the mortality ranged formerly from 910 to 1,165, and therefore was considerably higher than in last week, though the population in those years was less. The increase of 56 now observed on the week ending November 3 partly arises from pneumonia and bronchitis, the deaths from which become more numerous as the winter advances, having been 104 in the previous week, 127 in the last. The total number of deaths from cholera in the week was only six (five less than in the previous week); in the same week of 1848 there were 62. The steady decline of diarrhœa and dysentery is shown by the numbers of the last five weeks, which were respectively 105, 63, 51, 40, and 29. A boy died of diarrhœa in Peterborough-row, Fulham, whose father had been carried off by cholera in September; a boy of the same disease at Brudenell-place, New North-road, from an unwholesome condition of the house; and a girl at Maidstone-place, in the house in which a death from cholera, reported in the former week, occurred, and in a locality then described as "low and ill-drained." Of the six deaths from cholera, one occurred at Water-lane, Homerton; one at Weatherhead-gardens (Hackney-road), a place low, undrained, and drenched by waste water; one in Christchurch, St. Saviour's; one at Drummond-road, St. James's, Bermondsey; one in Walworth, and one in Lambeth. A death from apoplexy, on which an inquest was held, occurred in Huntingdon-street, Hoxton. The deceased was a woman of 65, who for the last four years had lived in an underground cellar, which is only 11 feet in length, 8 feet 6 inches in width, 5 feet 9 inches in height, and sunk 5 feet 7 inches below the surface of the street! A small window scarce gives light or ventilation, and "the walls," says the registrar, "are so damp that you might brush the water from them."

The mean daily reading of the barometer was above 30 inches on the last three days of the week. The mean of the week was 29.732. The temperature on the last three days was considerably higher than the average of the same days in seven years. The mean of the week was 50.2 degrees, which is higher than the average by 4.1.

J. Chanter, London, Esq., and J. Gray, Liverpool, engineer, for a new combination of parts forming an improved furnace for consuming smoke and economizing fuel, applicable to locomotive carriages, steam-boats, and other useful purposes. Patent dated November 2d, 1835; expired November 2d, 1849.

STATEMENT IN CONTINUATION OF THE ONE PUBLISHED IN THE CHEMICAL TIMES OF NOV. 10, 1849, SHOWING THE RELATIVE ELECTRICAL CONDITION OF THE EARTH AND THE AIR FROM NOV. 4 TO NOV. 10 INCLUSIVE, AS INDICATED BY THE EVAPORATION OF WATER FROM TWO COPPER VESSELS OR SCALES, ONE INSULATED AND THE OTHER NOT. ALSO THE READING OF THE BAROMETER, THERMOMETER, DIRECTION OF WIND, AND GENERAL STATE OF THE WEATHER.

Nov. 1849.	Barometer.		Therm.		Scales.				Wind.		General state of weather.
	Morning.	Evening.	Morning.	Evening.	Morning.	Evening.	Insulated	Non-Insulated	Morning.	Evening.	
4	29.25	29.10	52	51	20 N.	10 I.	10	20	E.	W.	Fog; misty rain and overcast all day.
5	29.10	29.35	46	45	..	..	..	..	W.	W.	Fine, but dense black clouds at noon, indicative of rain having fallen at no great distance to windward.
6	29.55	29.82	42	42	..	..	..	..	W.	W.	Fine all day.
7	30 00	30 07	40	45	..	20 N.	..	20	W.	W.	Rain all day.
8	30.25	30.35	57	56	10 I.	..	10	..	SW.	SW.	Overcast all day.
9	30.35	30.30	56	54	10 I.	10 N.	10	10	SW.	SW.	Rather fine all day, but overcast at night.
10	30.27	30.25	54	51	..	..	..	..	W.	SW.	Fine all day, but heavy fall of dew at night.

It appears from the press that "Sir John Herschel has lately expressed his opinion that it is impossible any longer to attempt the explanation of the movements of all the heavenly bodies by simple attraction, as understood by the Newtonian theory—comets, with their trains, perversely turned from the sun, deranging sadly our systematic views." This is decidedly a great step in the right direction, and if the reason assigned be not deemed sufficient to justify the opinion expressed more valid will shortly be supplied.

Westminster-road, Nov. 13, 1849. FRANKLIN COXWORTHY, Author of "Electrical Condition," &c.

MISCELLANEA.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Alexander Munkittrich, Manchester, merchant, for an improved composition of matters, which is applicable as a substitute for oil to the lubrication of machinery, and for other purposes. Patent dated May 1st, 1849. Enrolled November 1st, 1849.

This improved lubricating composition consists of 4 lbs. of caoutchouc dissolved in some suitable solvent, 1 lb. of glue, 10 lbs. of carbonate of soda, 10 gallons of animal or vegetable oil, and 10 gallons of water. The water is boiled, and the glue and carbonate of soda dissolved therein, after which the caoutchouc and oil are added, and the whole well stirred together until it becomes homogeneous and as fluent as oil. It is then ready for use, and may be stored in casks and bottles until wanted. The patentee states that any substances possessing the same properties as the preceding may be substituted for them, and that, when the caoutchouc and oil are previously purified, the carbonate may be dispensed with; also, that the proportions may be varied according to the degree of consistency required.

Claim.—The combination of the ingredients before named, or of any substances possessing the same properties, employed to form any analogous compound (whether in the proportions stated or varied to any practicable extent), which may be used as a substitute for oil to lubricate machinery, or for other purposes.

James Wilson, Old Bond-street, tailor, for improvements in trusses. Patent dated May 1st, 1849. Enrolled November 1st, 1849.

The spring of Mr. Wilson's truss is so bent that it is made to ascend from the front pad, and, passing above the hip, to rest upon it, whence it descends, terminating in the back pad, which presses against the back. The truss is supported by a waste belt or spring.

Claim.—The improved mode of manufacturing trusses, as described.

John Dalton, Hollingworth, Cheshire, calico-printer, for a certain improvement in printing calicoes and other surfaces. Patent dated May 1st, 1849. Enrolled November 1st, 1849.

Mr. Dalton states that the "lapping" or covering of the printing cylinder, and the endless band of blanketing, used to sustain the fabric, are liable to great wear and tear from the abrasion of their surfaces, and to "flocking," which produces great unevenness of surface, and consequently of printing; and he proposes to remedy these disadvantages by coating the fabric employed with a solution of gutta percha, in the proportions of 5 lbs. of the gum to 1 gallon of solvent. The solution is placed in the colour-box of the machine, which is made air-tight, and heated to 150° Fah. (in the case of benzole or bisulphuret of carbon being used, it is heated to 100° Fah., or to from 70° to 80° Fah. respectively). The solution is conveyed to printing cylinders, or, as it were, printed on the fabric by a roller placed between it and the colour-box, which is engraved with a reverse pen pattern, in order to press the solution into the fabric, which is afterwards carried over steam-chests and steam-drums to volatilize the solvent, when the gutta percha will be found perfectly adhering to the fabric. Or, the blanketing used to sustain the fabric during the printing may be composed of two endless webs, having their opposite surfaces coated with the gutta percha solution, and afterwards united into one band by being subjected to pressure and heat.

Claims.—1. The novel combination of materials, their preparation and application to the lapping or covering of printing cylinders employed in printing calico, muslin, paper, and other surfaces, or any modification of them applicable to the same purpose.

2. The novel combination and preparation of materials, and their application to the endless web of blanketing employed in printing, or any modification applicable to the same purpose.

James Godfrey Wilson, Millman's-row, Chelsea, engineer, for certain improvements in the manufacture of glass, and in machinery and apparatus connected therewith. Patent dated May 1st, 1849.

1. The melting-furnace is proposed to be constructed with a ring resting on anti-friction rollers, which is made to revolve as occasion may require by means of toothed gearing. Motion is communicated from the outside by a winch-handle. The pots, which are constructed with corrugated or angular surfaces to retain the heat, are placed on the ring, which is fluted at top to allow free passage to the heat. The top of the dome is constructed with a deflecting surface, in the shape of two parabolas joined together at the sides, whereby the heat which escapes from the side of the pots is reverberated on to the surface of the metal. The door or mouth of the furnace is closed by a mouthpiece, having two recesses on the opposite sides, and supported on a spindle, whereby it is made to revolve by any ordinary means. When it is desired to introduce a pot into the furnace, it is placed in the exterior recess of the mouthpiece, which is made to rotate until it is brought inside. The pot is then pushed, by means of tools passing through holes in the mouthpiece, on to the ring, which, by its revolution, carries the pot further into the furnace. The arrangements for withdrawing the pots are necessarily the converse of the preceding.

2. The furnace is to be fed from a hopper through an inclined shoot, in which an Archimedean screw works.

3. The casting-table is constructed of cored bars of iron, which are bolted together and heated by the introduction of steam previous to the metal being poured in, for the purpose of preventing the too sudden expansion of the table. It is proposed to place a similarly cored slab of iron, constructed in sections, above the casting-table, and resting on ledges on the interior of the sides thereof. Some suitable elastic material is laid on the joints, which, as the air is exhausted from the space between the two tables, is forced in by atmospheric pressure, and closes them hermetically. The mouth of the top table is closed by one half of a cylinder, which fits into it exactly—the other half being cut away, so as to allow the metal to flow in when brought into position by a partial revolution. The table is also provided with a species of safety-valve apparatus for allowing the vapour from the metal to escape.

4. The grinding and polishing table is perforated, and communicates with an exhausting apparatus. Strips of gutta percha or vulcanized indiarubber are arranged upon its top surface, on which the plate of glass is laid. The air is then exhausted from the under side, and the plate secured by atmospheric pressure, without being liable to fracture, during the grinding and polishing process. Or, the top of the table is to be covered with some suitable material, such as gutta percha, which is rendered plastic by the application of heat, and on which the plate is laid, and imbedded by its cooling. When the plate is finished and to be removed, the gutta percha is rendered plastic, as before.

5. Instead of using a "ponty rod" in the manufacture of glass, as hitherto, it is now proposed to employ a rod with elastic arms, which embrace the globe and expand with it when the "flashing" takes place.

Claims.—1. The improvements in the construction and arrangement of melting-furnaces, and in the form of the pots, whereby their removal from and placing in the former is facilitated, and a greater and more uniform degree of heat is obtained.

2. The self-acting apparatus for feeding the furnace.

3. The construction of casting-tables in sections; also the mode of constructing them for the purpose of casting slabs of glass *in vacuo*.

4. The mode of arranging tables whereby plates of glass are retained in position by atmospheric pressure, or imbedded in some plastic material during the grinding and polishing operations.

5. The mode of making crown glass.

John Robertson, Brooklyn, for an improvement in manufacturing sheet lead.

Claim.—A mode of manufacturing such hollow cylindrical forms of lead, and other soft metals and compounds, into sheets, by first placing them round a roller whose axis may be in a horizontal plane, or in one of any inclination, and then rolling it by any known mechanical means, until it shall be rolled to a proper thickness, substantially as set forth, whereby handling the sheet during the process is avoided, and a continuous rotary motion in one direction may be given to the rolls. Also, the construction of the carrying-roller, constructed substantially as set forth, and the manufacture therewith of hollow cylindrical-formed pieces of lead, or other soft metal or compound, into sheets by rolling, combined with the movcable bearings and pressing roller or rollers, substantially as set forth. And lastly, the manufacture of lead, or other soft metal or compound, into sheets, by supporting a hollow form thereof, and rolling it by one or more pressing rollers, forced against the outside of the form as it becomes thinner, and drawing out the extended form when required.

Samuel Rodman, for an improvement in lamps.

This invention consists in an improvement on the argand lamps, which is in substituting for the tubular woven wick a series of small wicks passing through perforations drilled in a heavy metallic tube, surrounding the central air-tube.

Claim.—The combination and arrangement of the heavy metallic tube or burner, having longitudinal perforations filled with a series of wicks, with the central air-tube, substantially as set forth.

Timothy D. Jackson, for an improvement in alloys for sheet metals.

The materials employed in making this alloy are copper 64 ounces, zinc 22 to 26 ounces, India tin 1 to 4 ounces.

Lewis J. Cohen, for an improvement in the composition of slate pencils.

Claim.—What I claim as my invention is the mixing or combining, in certain proportions, the materials of alumina (in any of its forms), with French chalk, or with soap-stone, in combination with water, for making of a clay or mass for making white slate pencils, and the process of making the same, as set forth.

John H. Hecker, for an improvement in an apparatus for drawing and measuring liquids.

"The nature of my invention consists in forming, in the tubes through which the liquid flows from the cask to the measure, a segment chamber containing a valve, which is moved up and down, to let on or stop off the flow of the liquid as required, by means of levers, springs, suspended float, and other mechanical contrivances, so combined and arranged, in relation to the valve, as to close said valve and stop off the flow of the liquid from the cask, without the aid of an attendant, by the rising of the liquid in the measure acting on the float, causing the fastening (holding the valve open) to be detached from the lever to which the valve is secured, and allowing the valve to be forced down by a spring pressing against the lever. And also, in combining with the apparatus an alarum-bell, which is caused to strike when the valve is closed, in order to call the attention of the attendant to the fact."

Claim.—The mode of measuring liquids by means of the combination of the measure, tubes, valve, lever, hinged bar, catch, roller, springs, cord, and float, arranged and operated as set forth. "I also claim the combination of the alarum with the measuring apparatus, by means of the lever and chain, for giving notice when the measure is filled and the valve or gate is shut as set forth."

PATENTS RECENTLY GRANTED.

LIST OF ENGLISH PATENTS GRANTED FOR THE WEEK ENDING NOVEMBER 10, 1849.

John Cowley, of Walsall, in the county of Stafford, manufacturer, and John Hickman, of Aston, in the county of Warwick, clerk, for improvements in the manufacture of bedsteads, chairs, tables, couches, and tubular and hollow articles. Patent dated November 2d, 1849; six months.

George Parke Macindoe, residing at Mountblow, in Scotland, for certain improvements in machinery or apparatus applicable to the preparation, spinning, and doubling or twisting of cotton, wool, silk, flax, and other fibrous substances. Patent dated November 2d, 1849; six months.

Adam Cottam, of the firm of John Elce and Company, of Manchester, machine-makers, for improvements in machinery to be used in preparing and spinning cotton and other fibrous substances. Patent dated November 2d, 1849; six months.

John Jordan, of Liverpool, engineer, for certain improvements in the construction of ships and other vessels navigating on water. Patent dated November 2d, 1849; six months.

Frederick Octavius Palmer, of Great Sutton-street, Middlesex, gent., for certain improvements in the manufacture of candles, and also in the machinery for the manufacture of such matters. Patent dated November 2d, 1849; six months.

Lucien Vidie, of Paris, but now of South-street, Finsbury, French advocate, for certain improvements in conveyances on land and water. Patent dated November 2d, 1849; six months.

Charles Cowper, of Southampton-buildings, Chancery-lane, for certain improvements in the treatment of coal, and in separating coal and other substances from foreign matters, and in the manufacture of artificial fuel and coke, in the distillation and treatment of tar and other products from coal, together with improvements in the machinery and apparatus employed for the said purposes. Patent dated November 2d, 1849.—(Communication.)

Michael John Haines, of Lucas-street, Commercial-road East, leather-pipe-maker, for improvements in the manufacture of bands for driving machinery, in hose or pipes, and buffers for railway purposes. Patent dated November 2d, 1849; six months.

William Buckwell, of the Artificial Granite Works, Battersea, civil engineer, and Joseph Apsey, of Blackfriars, in the same county, engineer, for improvements in steam-engines and in propelling vessels. Patent dated November 2d, 1849; six months.

Hiram Tucker, of Roxbury, in the State of Massachusetts, of the United States of America, for a certain new or improved manufacture of mantelpieces. Patent dated November 2d, 1849; six months.

William Morris, of Coldbath-square, in the county of Middlesex, civil engineer, for improvements in the preparing of clay, and in the manufacture of bricks, tiles, and other articles made of clay or brick earth. Patent dated November 2d, 1849; six months.

James Combe, of Belfast, Ireland, engineer and machinist, for improvements in machinery for hackling flax and hemp, and in machinery for producing flax yarns. Patent dated November 2d, 1849; six months.

Alfred Barlow, of Friday-street, warehouseman, for certain improvements in weaving. Patent dated November 2d, 1849; six months.

William Edward Newton, of Chancery-lane, civil engineer, for improvements in machinery for dressing, shaping, cutting, and drilling or boring rocks or stone, parts of which improvements are, with certain modifications, applicable to machinery or apparatus for driving piles. Patent dated November 6th, 1849.—(Communication.)

James Buck Wilson, of St. Helen's, in the county of Lancaster, ropemaker, for certain improvements in wire ropes. Patent dated November 8th, 1849; six months.

Charles Edwards Amos, of the Grove, Southwark, engineer, and Moses Clarke, of St. Mary Cray, in the county of Kent, engineer, for improvements in the manufacture of paper, and in the apparatus and machinery used therein; part of which apparatus or machinery is applicable for regulating the pressure of fluids for various purposes. Patent dated November 10th, 1849; six months.

Charles Mathew Barker, of Lower Kennington-lane, Surrey, engineer, for improvements in sawing or cutting wood and metals. Patent dated November 10th, 1849; six months.

Richard Ford Sturges and Jonathan Harlow, of Birmingham, for improvements in bedsteads. Patent dated November 10th, 1849; six months.

Thomas Keeley, of the town and county of Nottingham, manufacturer, and William Wilkinson, of the same place, framework-knitter, for certain improvements in looped or elastic fabrics, and in articles made therefrom; also certain machinery for producing the said improvements, which is applicable in whole or in part to the manufacture of looped fabrics generally. Patent dated November 10th, 1849; six months.

Samuel Brown Oliver, of Woodford, in the county of Essex, gentleman, for certain improvements in dyeing and dyeing materials. Patent dated November 10th, 1849; six months.—(Communication.)

Henry Henson Henson, of Hampstead, in the county of Middlesex, gentleman, for certain improvements in railways, and in railway carriages. Patent dated June 14th, 1849, by order of the Lord Chancellor; six months.

[This and the following patent, being opposed by caveat at the Great Seal, were not sealed until the 10th of November, 1849; but bear respectively the date they would have been sealed had no such opposition been entered.]

Rowland Brotherhood, of Chippenham, in the county of Wilts, railway-contractor, for an apparatus or mode of covering trucks and waggons on railways, road waggons, and canal boats, so as effectually to prevent goods in the course of public transit from theft or damage, and at the same time to allow of such trucks and waggons being loaded and unloaded with equal facility. Patent dated July 18th, 1849, by order of the Lord Chancellor; six months.

PATENTS RECENTLY EXPIRED.

W. Crofts, Radford, machine-maker, for certain improvements in machinery for making bobbin-net lace, parts of which improvements are for the purpose of making figured or ornamented bobbin-net lace. Patent dated November 4th, 1835; expired November 4th, 1849.

J. Whitehead, Old Brompton, chemist, for certain improvements in scouring and cleansing. Patent dated November 5th, 1835; expired November 5th, 1849.

Thomas Earl of Dundonald, for improvements in machinery and apparatus applicable to purposes of locomotion. Patent dated November 5th, 1835; expired November 5th, 1849.

H. Adcock, Birmingham, engineer, for certain improvements in docks and quays, to facilitate the importation and exportation of merchandise, and abridge labour. Patent dated November 5th, 1835; expired November 5th, 1849.

W. Symington, Bromley, cooper, for certain improvements in the machinery for propelling vessels by steam, parts of which are also applicable to motive machinery of other descriptions, whether actuated by steam or any other moving power. Patent dated November 7th, 1835; expired November 7th, 1849.

J. Wilde, New York, merchant, and J. Whit-

worth, Manchester, engineer, for certain machinery for effecting the operation called knitting, and producing a fabric similar to that of knitted stockings. Patent dated November 10th, 1835; expired November 10th, 1849.—(Communication.)

T. Gregg, Lancaster, calico-printer, for a mode of embossing and printing at one and the same time, by means of a cylinder or roller, on goods and fabrics, made of or from cotton, silk, hemp, or wool, or any one or more of these materials, or on paper. Patent dated November 10th, 1835; expired November 10th, 1849.

D. Mushett, Coleford, ironmaster, for a certain improvement in the art of making or manufacturing bar iron or malleable iron. Patent dated October 22d, 1835; expired October 22d, 1849.

J. Walton, Halifax, frizer, for certain improvements in dressing, finishing, and setting the face on woollen or other cloths requiring such process. Patent dated October 23d, 1835; expired October 23d, 1849.

G. Baxter, London, engraver, for improvements in producing coloured steel plate, copper-plate, and other impressions. Patent dated October 23d, 1835; expired October 23d, 1849.

J. Birkby, Leeds, cardmaker, for improvements in machinery for pointing wire, applicable for making of cards and pins. Patent dated October 29th, 1835; expired October 29th, 1849.

J. Springall, Oulton, ironfounder, and R. Ransome, for an improved mode of manufacturing certain parts of ploughs. Patent dated Nov. 2d, 1835; expired November 2d, 1849.

W. Keene, Bankside, engineer, for certain improvements in machinery or apparatus for sowing corn, grain, and other seed, and manuring land. Patent dated November 2d, 1835; expired November 2d, 1849.—(Communication.)

Alleged Death from Impure Vaccine Lymph.—At an inquest recently held before Mr. T. Wakley, M.P., the coroner, at the Vineyard-house, Vineyard-walk, Clerkenwell, touching the death of an infant named Rosina Elizabeth Pilcher, aged four months, who was alleged to have died from the effects of impure lymph, the jury returned a verdict "That the deceased died from erysipelatous inflammation, which had been produced by a puncture on the left arm for vaccination, and they were of opinion that there was a want of sufficient care on the part of the operator."

Parks for the People.—It is to be hoped that if Smithfield Market be removed the space will be immediately converted into a city green. What was formerly necessary when London was much smaller, and, from its hitherto long form and narrow width, more healthy in its internal parts than it can be in future (unless care be taken, whilst there is yet time and opportunity), is much more necessary now, and the consequences will show themselves, if precautions be neglected. One grand benefit to London will be to preserve an opening into the sides of it, both north and south; and the effects of this will be manifest; it will cause a current of comparatively pure air into the very centre of the metropolis, and also be the means of a pleasant, safe, and short access to open ground, green fields, or walks, parks, or broadways (as may be provided), for the benefit of the health and morals of thousands of individuals who otherwise must be deprived of one of the greatest blessings of Heaven. On the north side of London the opening that would be beneficial is from Holborn to King's-cross, viâ Gray's-inn-road, by certain improvements and widenings in sundry places, as opportunity would permit, with wide and safe footpaths; thence to Highgate, or so far as might be obtainable either in progress thereto, or in extent of space as public ground, terminating at nearer distance from King's-cross. The ground from King's-cross to Highgate, by way of Maiden-lane and Chalk-road, affords facility for the purposes desired, and 10 acres of ground obtained here are more valuable, as a general service to the inhabitants of the middle portion of London, than 100 acres at the extreme ends. The high ground about Copenhagen is an invaluable spot for the formation of a reservoir of air, both for the supply of the centre of London and for the access thereto of the inhabitants. If the opportunity be neglected now, when small comparative expense will effect it, the time will come when the most extensive demolition must be effected in order to air London, and give space for its inhabitants; fever and plague will not be stayed till thousands upon thousands be expended in this manner, and the very spots now uncovered will be then again laid bare for obvious purposes of general need.—*Builder.*

Burntisland. — Rock Blasting on a Gigantic Scale.—Among the many and varied gifts which science has recently conferred upon mankind, that of blasting rocks by voltaic agency is not among the least. The employment of a galvanic current to ignite the gunpowder used in the process enables the operator to fire as many blasts as may be desired, so as to accomplish, by their united and simultaneous action, effects which would be otherwise unattainable. The spirited tacksmen of that valuable and extensive freestone deposit in this neighbourhood, well known as the Grange Quarry, have for a considerable time past been employing this potent agent in the blasting of rock, and on Saturday week there was an exhibition of this process on what may be fitly termed a magnificent scale. The mass of freestone which it was intended to dislodge was one which protruded from the face of the quarry, being a huge body of liver rock. On the upper surface of this mass, and in a line with the face of the quarry, from which it was to be severed, there were six vertical perforations, about ten feet apart from each other. Each bore was 40 feet in depth, reaching to the bed on which the block reposed, and 300 pounds of gunpowder were distributed amongst the six, thus giving 50 pounds to each. The wires for conveying the subtile agent of ignition to the explosive material deposited in each perforation in the rocky mass having been properly adjusted, and connected with the galvanic machine, everything was ready for the experiment. The battery was then placed in the trough containing the requisite aciduous solution, and the operator seized a cord or lanyard, and drawing the moveable disc along the cylindrical rod which stretched across the top of the battery, until it came in contact with the fixed disc—thus completing the galvanic circuit—the cartridge-wires were quickly and simultaneously heated, the powder ignited, and the object was gained, the whole operation being eminently successful. There was no terrific explosion, and the enormous block thus dislodged moved quickly, but gently and quietly, forward on its bed. On examining the vast block which had thus been riven from its place, it was found that it had been completely separated from the parent rock in the rear, a fissure about five inches wide, and quite smooth on each side, reaching from the top down to the depth of 40 feet, while in front it overshot its bed to the same extent. This Cyclopian mass of beautiful sandstone measured 63 feet in length, 31 in breadth, and 40 in depth! Its cubic contents amount to 78,120 feet, which, at 14 cubic feet per ton, gives 5,580 tons as its weight! The total length of wire employed in the operation measured about 500 feet. The battery used on this occasion was one of considerable power, the copper and zinc plates in it being 48 in number, each having a surface of 12 inches by 11.—*Fife Herald.*

The Magnetization of Heat.—Shortly after the brilliant discovery by Faraday of the rotation of the plane of polarization of light produced by magnetism, M. Wartmann announced that he had tried the same experiment upon radiating heat. Many practical difficulties presented themselves. He employed the heat of a lamp, which he partially polarized by passing it through two piles of mica crossed at right angles. Between these piles were placed the electro-magnets, and a cylinder of rock-salt, and consequently very near the thermo-electric apparatus. The galvanometer, on the contrary, in order that the action of the electro-magnets might be preserved, was at some distance; the consequence of which was a considerable increase of the length of the circuit, and a decrease of sensibility. In spite of these inconveniences, which he had clearly seen, but could not remove, M. Wartmann believed that he observed that the needle of the galvanometer, taking up a stable deviation under the influence of the ray not intercepted by the piles of mica, was displaced anew, and took a fixed position, different from the first, when the current was established, which seemed to prove rotation of the plane of polarization of heat. Several persons are said to have failed in the attempt to reproduce the phenomenon, but MM. de la Prevostaye and Desains have succeeded, modifying, however, the process of M. Wartmann:—1st, they employed solar light; 2d, they used for the polarizing apparatus two prisms of achromatized spar; and 3d, which appeared to them indispensable, instead of placing the principal sections at 90°, they arranged them at an angle of very nearly 45°. They fully believe that their experiments establish, beyond a doubt, the rotation of the plane of polarization of heat under the influence of magnetism.

The Aurora Borealis.—M. De la Rive experimentally supports the hypothesis that the luminous matter of the aurora is due to the electric fluid contained in the atmosphere at great heights, where the air is rarefied. He shows that the light which results from the reunion of the two electricities in the upper part of the atmosphere of the polar regions, instead of remaining indefinitely distributed, is carried by the action of terrestrial magnetism round the magnetic pole of the globe, whence it seems to raise itself in a whirling column. This explains, he thinks, why the magnetic pole is always the apparent centre from which the light that constitutes the aurora borealis proceeds, or towards which it seems to converge.

TO CORRESPONDENTS.

"G. R."—Your communication has been forwarded to the patentee.

"B. W. S."—We cannot undertake to analyze the sample of guano forwarded to us by our correspondent.

"Mr. Miller, Birmingham."—You may use either of the three acids indiscriminately.

"An Apothecary."—The article is liable to the stamp duty.

"W. S., Dublin."—Apply to your bookseller. We are unable to give you the desired information.

"Mr. B. C. Whitman, Bristol."—Write to the librarian of the British Museum. If the manuscript is genuine, we have no doubt you will get a reasonable price for it.

"A Novice."—You may procure a small single-barrelled air-pump for about £2 or £2 10s. at Mr. Simpson's, of Newington-causeway.

"Alpha" has been answered in No. 166.

"T."—The Chinese prepare the sheet lead intended to encase the tea in the following way:—Molten lead is poured from a crucible upon a large flat stone, placed upon the ground; another stone, of equal size, is then dashed upon the fluid lead and pressed down forcibly. By this means the lead is pressed out into a very thin leaf, which is then at once removed from the stone, and the operation repeated with the greatest possible rapidity. The rough edges of the plates are subsequently cut off, and the plates soldered together for use. The process requires two men—the one to pour on the melted lead, and the other to work the stones.

"Mr. Walter, Kennington-road."—Copper and brass may be silvered in an apparatus by means of a solution of one part of nitrate of fused silver in five and a third parts of liquor of ammonia; but the first immersion must not last longer than a second.

London: Printed by Robert Palmer, of No. 13, Providence-place, Upper Kennington-lane, Lambeth (at the Printing-office of Robert Palmer and Joseph Clayton), at No. 10, Crane-court, Fleet-street, parish of St. Dunstan-in-the-West, in the City of London, and published by the said Robert Palmer, at the Publishing-office, No. 49, Essex-street, in the parish of St. Clement Danes, and at 320, Strand, in the City of Westminster.—November 17, 1849.

Ferric Acid. (Turner. 8th Edition)

The existence of this compound has been established by the researches of Wenham Smith and Fremy. It is formed when Iron filings are deflagrated with nitre, or when chlorine is passed through a strong solution of potassa or soda in which hydrated peroxide of Iron is suspended.

In both cases, the ferric acid unites with the alkali, forming a salt of a very deep purple colour. The ferrate of potash is soluble in water, but is precipitated as a dark red, nearly black powder, by a large excess of the alkali; and this powder may be preserved in sealed tubes

The acid is rapidly decomposed when separated from its salts, yielding oxygen and peroxide. It corresponds in composition to manganic acid —

At. eq. = 52; Symb. $Fe + 3O$, or FeO_3.

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